Program Work Statements

Environmental Assessment of the Alaskan Continental Shelf

2 – Marine Birds

U. S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration

U. S. DEPARTMENT OF INTERIOR
Bureau of Land Management

CONTENTS - MARINE BIRDS

REVISED PROJECT PROPOSAL WORK STATEMENT
Alaska Department of Fish and Game

RU #3/#4

I. Title

IDENTIFICATION, DOCUMENTATION AND DELINEATION OF COASTAL MIGRATORY BIRD HABITAT IN ALASKA

II. Principal Investigator

Karl Schneider, Regional Research Supervisor
Alaska Department of Fish & Game 333 Raspberry Road Anchorage, Alaska 99502

III. Geographic Area and Inclusive Dates

Coastal habitats in the Gulf of Alaska, Bering Sea and Beaufort Sea - September 1, 1975 through September 30, 1976.

IV. Cost Summary

Personnel and operating costs, except logistics	- $126,311
Logistics	- 22,500
State overhead	- 14,881
Total Project Cost	- 163,692

V. Proposed Research

A. Background and Objectives

1) Task element objectives of primary and secondary emphasis in this proposal.

A-4. Summarize and evaluate existing literature and unpublished data on the distribution, abundance, behavior, and food dependencies of birds associated with littonal and estuarine habitat in the Gulf of Alaska, Bering Sea and Beaufort Sea; and on barrier islands in the Beaufort Sea.

A-5. Determine the seasonal density distribution, critical habitats, migratory routes, and breeding locales for principal bird species in littoral and estuarine habitat in the Gulf of Alaska, Bering Sea and Beaufort Sea; and on barrier islands in the Beaufort Sea. Identify critical species particularly in regard to possible effects of oil and gas development.

b) Secondary Task Element

A-6 -- Describe dynamics and trophic relationships of selected species at coastal study sites on the Beaufort Sea.

2) State of present knowledge.

Coastal migratory bird habitat in Alaska is vital to millions of waterfowl, tens of millions of seabirds and perhaps hundreds of millions of shorebirds and other migratory birds. Most major waterfowl, shorebird and seabird habitats are known, but in most instances bird use is not well quantified. Many areas of lesser importance have not been identified.

Some important state-owned migratory bird coastal habitats have been formally recognized by their legislative designation as critical habitat. However, much of the data supporting this legislation have not been published. Some of the important associated coastal uplands have been recognized by the U.S. Fish and Wildlife Service and have been made Federal wildlife refuges.

The most current published list of known sea bird colonies is found in Alaska's Wildlife and Habitat (Ak. Dept. Fish and Game, 1973). However, more colonies have been located by various people, and better quantified species data have since been collected for some colonies.

Although major migration routes and chronology of migration along Alaska's coast are generally known, the knowledge is only superficial. Migration data generally have not been systematically collected, except for one study in Prince William Sound being conducted by Pete Islieb, funded by the U.S.F.W.S.

The vegetation on a few coastal marshes has been superficially described but only one marsh has been described in detail (Crow, 1968). Crow has also done some vegetative work in Prince William Sound, Cook Inlet and in Southeast Alaska.

In the Beaufort Seas the near shore barrier islands and associated lagoons from Pt. Barrow to the U.S.-Canadian border appear to be critical for nesting, molting and resting migratory birds. Investigators from the U.S. Fish and Wildlife Service, University of Alaska, and oil companies have quantified bird nesting on some of the islands. However, only one intensive bird study on one island has been conducted (Schamel, 1974).

One study (Bartels, 1973) resulted in an estimate of up to 337,000 old squaws using the shallow coastal waters from Pt. Barrow to the Sagavanirtok River delta during the fall. However, sampling intensity in this study was quite minimal. Bartel's main emphasis was placed on off-shore bird assessments rather than coastal. King and Lensink (1971) estimated that two-thirds of the bird fauna of the Canadian Arctic Islands move parallel to northern Alaska across the Beaufort Sea.

There are over 50 species of birds utilizing near shore areas of the Beaufort Sea. However, except for one or two species, we have no estimates of bird abundance by time period. There is also essentially no information on bird food habits; nor is there a good understanding of migration timing (bird abundance) as related to ice breakup and weather.

In summary, a considerable amount of data and information exists on coastal habitats and associated bird populations. However, much of the information is fragmented and miscellaneous. Data were generally not collected in a systematic manner, so bird density distribution information for most areas is not available.

3) Information required to meet the task objective.

A-4. Various coastal bird surveys have been made by state and federal personnel and private industry. Unpublished and published data from these ground and aerial surveys must be obtained, reviewed and synthesized with data collected in this proposal.

A-5. a) Locations of coastal migratory bird habitat.

b) Quantification of bird use of the habitats by:

- species of birds
- density distribution by species
- periods of use
- type of use
- Key species (those species dependent upon given habitat to a major degree). - critical species (those species classified as rare and endangered or threatened).

c) Physical description of the habitats.

d) Identification of important habitat because of: the number of birds using; the vulnerability to contamination; the presence of key and/or critical bird species; and other factors.

A-6. Information on the food habits of major species of birds using the Beaufort Sea coast is needed. This information should be collected for various geographical locations as well as by time intervals throughout the bird use period.

4) Extent of task objectives which can be accomplished in FY 76.

A-4. It is anticipated that all pertinent literature will be reviewed before August 1, 1976 and a preliminary evaluation report written by August 1, 1976. A final report will be submitted upon completion of an appropriate review and the addition of supplemental information which will be obtained.

By August 1, the following products are anticipated for all OCS regions:

- preliminary identification and delineation of all major bird habitats

- preliminary identification and delineation of some secondary habitats

- initial identification of habitats which are of critical importance because of utilization by large numbers of birds; that are essential to the welfare of certain species; or that are otherwise of unique importance.

- a general description by region (Gulf, Bering and Beaufort) and by major habitat of: bird use by species; periods and type of use; and some density distribution information in selected areas

- physical descriptions of some major habitats

This work is considered to be the initial stage of a long-term study of coastal habitats in which coverage will be increased in extent and detail on a priority basis in subsequent years, as determined from these initial studies. This study is also viewed as the state commitment to a joint State-U.S. Fish and Wildlife Service effort to complete a coastal habitat study.

Element A-6 Anticipated products to be available by August 1, 1976 include:

- Preliminary analysis of foods habits of selected species in representative habits on a seasonal basis.

- Availability of 50-100 stomach samples for subsequent detailed analysis.

5) Related research being carried out by others and the degree and methods of coordination anticipated.

Most off-shore and some near-shore OCS bird work will be conducted under U.S.F.W.S. direction. Close coordination with them will be maintained to insure the most efficient use of funds.

Although not directly related, OCS marine mammal and fishery work will be conducted in this area by Department of Fish and Game people. Coordination will be maintained with them to possibly share equipment, facilities and aircraft charters.

Both OCS and non-OCS benthic organism studies are being and will be conducted at selected locations. For this study birds will be collected for food habits studies at some of these same locations in the Beaufort Sea to more fully understand the results of the food habits analyses.

Dr. George Petalka will be conducting a shorebird study in the Cape Halkett area. Coordination with him may result in shared charter costs.

Doug Schamel's analyses of bird observations on Egg Island will also prove very valuable and contact with him will be maintained.

LGL will be doing near-shore work in the Camden Bay area. Shared charter costs may be possible with them.

B. Methods

1) Efforts to use literature

It is anticipated that all pertinent archived, published and unpublished data will be synthesized with data collected in this study.

2) Temporal and spatial sampling scheme.

Due to the reduced project time span, only one complete field season of work is possible. Therefore, primary emphasis will be placed on the Beaufort Sea; and on habitats in the Bering Sea and Gulf of Alaska which: are known to be important to large numbers of birds; key or critical species of birds; or habitats which are most vulnerable to contamination.

Aerial transects have proven to be the most practical technique for sampling bird populations in large, remote areas. Therefore, surveys on transect lines will be made over inter-tidal and adjacent habitat, where the area to be surveyed is large. In some instances where the area is more confined such as a bay, total bird counts will be made.

In the Beaufort Sea, fixed-wing sampling intensity will be as intensive as availability of aircraft and local weather conditions allow. However, more effort will be made on river delta areas then elsewhere.

Helicopters will be used to assess populations of the smaller shorebirds in some areas. They will also be used for searching the off-shore islands in the Beaufort Sea.

Surveys will be designed to assess bird populations on major habitats throughout the bird use period, but generally at peak use periods.

Ground work based from field camps in selected areas will be conducted, resulting in more intensive sampling of small areas.

3) Criteria for deciding what species will be included for analysis.

All birds will be included for analysis that are encountered on the aerial and ground surveys.

Representative birds in each family will be selected for food habits analysis. Species of birds selected will be primarily based on abundance and ease of collecting.

4) Methods of analysis - references

Data will be analyzed by seasonal use period; by geographical location; and by species (or genera or family).

Some references to guide data analyses and presentation include: Schamel, 1974; Martinson and Kaczynski, 1967; Alaska Dept. Fish and Game, 1973; Bartels, 1973; Bartonek, 1969; Bureau of Sport Fisheries and Wildlife, 1969; Crow, 1968; King and Lensink, 1971; and various unpublished references pertaining to past coastal bird surveys by the U. S. Fish and Wildlife Service and Alaska Department of Fish and Game.

VI. Information Products (generally same as V-A-4)

The information products expected in this study (in the 13 month time frame) are:

A. Identification and delineation on maps of all major and most key and critical habitats.

B. Identification and delineation on maps of some secondary habitats.

C. The following descriptions by habitat and by region in varying degrees of completeness: bird use by species; periods and type of use; density distribution information.

D. Information on the species composition and relative population sizes of birds nesting on most barrier islands in the Beaufort Sea.

E. Information on food habits of selected species, in selected locations, at various time intervals throughout the use period in the Beaufort Sea.

F. Information on bird migration chronology by species, for one field season.

G. Identification of key and of critical species can be made (if they occur during the study period).

VII. Data or Sample Exchange Interfaces

As stated in V-A-5, there are a number of other studies which will generate data useful to this study--particularly those studies conducted by the U.S.F.W.S. Also, results of Dr. George Petalka's shorebird work in the Cape Halket area and Schamel's work on Egg Island will also have direct application. However, data or samples from other studies are not essential to insure the completion of this proposal (for this fiscal year anyway).

VIII. Sample Archival Requirements

The only archival requirements will be for data collected in this study. This includes:

- Statistical data on bird censuses by time period, geographical area and habitat type.
- Analyses of food content in up to 100 bird stomachs.
- Skins, skeltons or other bird parts from up to 100 birds may be archived in the collection of the Alaska Department of Fish and Game or other public institutions.

IX. Schedule

The following general schedule will be followed:

Fall 1975: Aerial surveys will be conducted on migration concentration areas in the Bering Sea, Gulf of Alaska and possibly the Bering Sea. Literature review and contact with other OCS investigators (both are a continual process) will be made. Hopefully birds can be collected on the Beaufort Sea coast.

Winter 1975-76: Aerial surveys will be made in the Gulf of Alaska to assess wintering bird populations. Map work delineating habitat will be done. Supplies and equipment necessary for spring and summer work will be purchased. Aircraft charters, field camps, transportation of supplies, etc. for the spring and summer seasons will be arranged.

Spring 1976: Field camps will be established on the beaufort Sea coast. Aerial surveys will be conducted by helicopter and fixed wing aircraft over migration concentration areas. Delineation of habitat on maps will continue (this also is a continual process). Birds will be collected on the Beaufort Sea coast for food habits analysis.

Summer thru September 30, 1976: Aerial and ground surveys will be made on the Beaufort Sea barrier islands and associated lagoons. Other coastal habitats will be surveyed to assess bird populations. Birds will be collected for food habits analysis on the Beaufort Sea. A final report will be written.

X. Special Equipment Requirements

Other than fixed-wing planes and helicopters, no special equipment is anticipated.

XI. Logistics Requirements

NARL helicopters and fixed wing aircraft will be used whenever possible. The approximate requirements for NARL aircraft support by time period are:

1976	Fixed Wing (hrs)	Helicopter (hrs)
May	10	
June	25	40
July	25	50
August	25	20
September	25	10

A more specific request for NARL support will be made as soon as possible--sometime before January 1, 1976.

The Alaska Department of Fish and Game will arrange all logistics. Whenever possible, logistic costs will be shared with other agencies and investigators.

Literature Cited

Alaska Department of Fish and Game. 1973. Alaska's Wildlife and Habitat. Juneau.

Bartels, R. F. 1973. Bird survey techniques on Alaska's north coast. Master of Science Thesis, Iowa State Univ. 1973.

Bartonek, J. C. 1969. The bird resources of Alaska's Arctic Slope and petroleum development. Admin. Rept., Northern Prairie Wildlife Research Center, Jamestown, N. Dakota. 28 pp.

Bureau of Sport Fisheries and Wildlife. 1969. Standard procedures for waterfowl propulation and habitat surveys. U. S. Government Printing Office, Washington, D. C. 68 pp.

Crow, J. H. 1968. Plant ecology of the Copper River Delta, Alaska. Doctor of Philosophy Thesis. Wash. St. Univ. 120 pp.

King, J. G. and C. J. Lensink. 1971. An evaluation of Alaskan Habitat for migratory birds. Unpubl. Rept. U. S. Dept. Interior, U. S. Fish and Wildl. Serv. Nov. 1971.

Martinson, R. K., and C. Kaczynski. 1967. Factors influencing waterfowl counts on aerial surveys, 1961-1966. Bur. of Sport Fisheries and Wildl. Spec. Sci. Rpt. --Wildl. 105. 77 pp.

Schamel, D. L. 1974. The breeding biology of the Pacific Eider on a barrier island in the Beaufort Sea, Alaska. Master of Science Thesis. Univ. Alaska. 95 pp.

Work Statement (Research Unit #38)

I. TITLE: A Census of Seabirds on the Pribilof Islands

II. PRINCIPAL INVESTIGATOR: Joseph J. Hickey

III. AREA AND DATES: Bering Sea--Pribilof Islands
1 June 1975--30 September 1976

IV. COST SUMMARY: $32,000 Total, $6,425 in FY 1975, $25,575 in FY 1976

V. PROPOSED RESEARCH

A. Background and Objectives

1. The primary task of this study is to define a major biological population which is subject to potential impact by petroleum exploration and development in the Bering Sea. The particular objectives of this research unit supporting Task A-5 are twofold:

(a) to obtain precise estimates, for as many species as is practical within the time framework of this study, of the breeding seabirds on the Pribilof Islands, and

(b) to explore the possibilities of obtaining refined estimates of those additional nesting populations that do not readily lend themselves to conventional census techniques.

2. No systematic census or population estimate of the seabirds of the Pribilofs has ever been attempted, although for almost a century ornithologists have reported their numbers as in the "millions." The project proposed here is to provide enumerational data on what undoubtedly is the largest aggregate of colonial birds anywhere in North America, as a baseline on which to estimate any subsequent effects and environmental impact of petroleum exploration and development on the birdlife of this part of the Bering Sea.

3. The information required to meet this objective will, if the project succeeds, consist of (a) actual counts of cliff-nesting species in the main colonies on St. George and St. Paul islands, (b) actual counts of the murres nesting on the top of Walrus Island, and (c) estimates (with confidence limits) of the numbers of puffins and auklets that nest in burrows on St. George and St. Paul.

4. The population estimates of the burrowing species should be available by 30 September 1976, although the confidence limits on these cannot be predicted at this time. The enumeration of ledge-nesting species will depend on (a) our success in getting aerial photos of the cliffs during the birds' nesting season and (b) the time required to analyze these photographs after they are developed. If we do get aircraft and the right cameras in 1976, it will take some months to analyze these pictures. Some sampling of them could be run late in the summer of 1976 in order to provide at least preliminary estimates of the cliff-nesting numbers by 30 September 1976.

5. We are unaware of any enumeration of seabird numbers by other investigators on such a colossal scale. The nesting success study of Dr. George Hunt on St. Paul Island may be of potential help to us in interpreting the aerial photos.

B. Methods

1. The ornithological literature, starting with Elliott's (1884) list of breeding birds on these islands, gives a rather accuarate fix on the number of species involved. There are no archived or published materials along the lines of the census we have in mind on these islands.

2. The sampling scheme for occupied burrows will be carried out on a stratified basis not only to control the variance encountered but also to cut down on sampling time. We hope to explore initially the effect of elevation on burrow density and in the end to use quadrats (probably 50 by 50 m) selected by a randomized process for each stratum. The sampling design on St. Paul will probably differ from that on St. George since strata there will take into account the greater degree of human interference on St. Paul. Ideally one would hope for ultimate confidence limits of 10%, but nothing of the variance is now known. This variance will be explored in 1975, and the sampling system carried out in 1976. The resulting calculations should be available by 30 September.

3. The actual bird species to be studied are those seabirds previously reported as nesting on the islands by Elliott (1884) and others. These fall into three groups:

   (a) Cliff-ledge-nesting species

   red-faced cormorant
   black-legged kittiwake
   red-legged kittiwake
   thick-billed murre
   common murre

   (The murres on Walrus Id. nest on the horizontal top surface of the island.)

(b) hole- and crevi ce-nesting species

parakeet auklet
crested auklet
least auklet
horned puffin
tufted puffin

4. The number of samples to be studied will consist of the nests of 10 species that are to be monitored each year. We will endeavor to discover and follow 500 such nests (50 for each species) in 1975 and 1000 (100 for each species) in 1976.

For five cliff-nesting species, we will be limited by the opportunities to monitor nesting activities on ledges that can be viewed from headlands and promontories. For the five remaining species, which nest in burrows and under rocks, we will run live transects and establish 1-square-meter quadrats at intervals of 1 to 10 meters. The number of nests to be finally counted will be determined statistically after we have determined the variance among such nests under various slope conditions. Two methods of analysis will be utilized.

(a) The usual method of censusing cliff-nesting seabirds in the past has been to photograph their cliffs from a boat and then count the birds photographed on the ledges. St. George has 29 miles of coastline, St. Paul 42. Only brief stretches of the cliffs can be inspected from the side or from below. We expect to count the birds regularly at these favorable sites so as to get at day-to-day and hour-to-hour differences in the number of birds occupying the ledges. We further hope to secure an aircraft to explore the possibility of photographing the cliff ledges during the nesting season. Osborne (1971) reports success in this fashion when a 35-mm camera was used through an open window of a high-wing aircraft with a low stall speed in a census of common murres at an altitude of 200-300 ft. in northern California. His actual results lack precision, and some of the 1000-ft. cliffs on the north side of St. George certainly present special problems. We will explore the possible use of aerial photographs by military reconnaissance aircraft shooting at an oblique angle in a complete survey of the cliffs of the four islands and a horizontal shot (or shots) of the top of Walrus Island.

When seabirds are counted on the nesting ledges of island cliffs, there still remains the problem of ascertaining whether each individual bird on the cliff represents a full pair (one bird being off

feeding), 1.5 birds (some mates feeding, some mates returned), etc. The correction factor to be used in our case will be worked out by concentrating observations on hour-to-hour and day-to-day attendance of birds on the ledges.

(b) Counting the numbers of burrows on quadrats will require tests of the actual occupancy of each burrow. We plan a system of straws mounted each afternoon across the entrance of each burrow in a given period as a test of activity or occupancy.

VI. INFORMATION PRODUCTS

The Information produced will involve population estimates of ten species of seabirds nesting on the Pribilofs in 1976. Confidence limits on these estimates will vary according to the variance and sampling problems encountered. Data will be supplied for archival purposes on magnetic tape.

VII. DATE-EXCHANGE INTERFACES

At the present time we contemplate needing none from other investigators. George Hunt could presumably use our census data to blow up an estimate of the total number of young birds produced on the Pribilofs in 1976, but at the present time we are not aware of what productivity differences exist between (say) birds nesting on St. Paul (where Hunt will run his study) and those nesting on St. George (where we will have to concentrate a major fraction of our field work).

VIII. SAMPLE ARCHIVAL REQUIREMENTS

None are contemplated at this time.

IX. SCHEDULE

Our schedule currently depends on the availability of boats and aircraft needed to get us back and forth between the islands, especially between St. Paul and St. George where inter-island service of about one boat per month is currently described for us by William Peck (pers. comm.) of the National Marine Fisheries Service. Until the availability of supporting boats and aircraft is spelled out, a detailed schedule is impossible.

Two types of preliminary surveys are indicated in 1975.

A. Transects on foot of the entire coastlines of St. Paul and St. George to map those cliffs where hour-to-hour and day-to-day variation in the use of the nesting ledges can be studied.

B. Transects cross-sectioning St. Paul and St. George on a north-south axis to explore the number of strata that should be used in counting burrows of the hole-nesting species. It is initially contemplated that these transects will be 50-meters wide, and that burrows (both used and not used) will be counted and recorded for each 100-m length of transect.

These surveys will permit the systematic gathering of data in 1976.

X. EQUIPMENT REQUIREMENTS

The one piece of special equipment required in this study is an aerial camera to photograph birds on ledges (St. Paul and St. George) and those on the top of Walrus Id. We have not yet sought to work out how to either borrow this equipment (from, say, the U. S. Fish and Wildlife Service, which has used such a camera in the recent past to census white pelicans) or secure the use of a military reconnaisance plane.

The university will provide two Bosch and Lomb telescopes, at least one camera with 200- and 600-mm lenses, stereo-viewer equipment for reading aerial photos, and desk calculators (Monroe 1785, Monroe 1930, and Canon 163).

XI. LOGISTICS REQUIREMENTS

In general, we need help in moving back and forth between St. Paul and St. George, but we have received no information from NOAA re vessels or aircraft that might be in the vicinity of the Pribilofs during the early part of each summer. Aircraft will be needed to carry out the photography outlined above.

We have some hope of getting some living quarters from the National Marine Fisheries Service, but nothing has been finalized in view of only preliminary action that NOAA has thus far taken our proposal.

The University of Wisconsin is not in a position to furnish any of these requirements.

WORK STATEMENT

Task A-6 -- Describe population dynamics and trophic relationships of selected species at offshore and coastal study sites.

I.	RESEARCH UNIT 77	Ecosystem Dynamics - Birds and Marine Mammals
II.	PRINCIPAL INVESTIGATOR	Michael F. Tillman, NMFS, Seattle, Washington
III.	BERING SEA	1 July 1975 to 30 September 1976
IV.	COST SUMMARY	-0- FY 1975 - through 30 June 1975 100.0 FY 1976 - 1 July 1975-30 September 1976

V. PROPOSED RESEARCH

A. Background and Objectives

At present, little is known about the dynamic behavior of the Bering Sea ecosystem. However, many pieces to this puzzle already exist as individual population assessments, oceanographic analyses, and food chain studies which have been undertaken by several research agencies. The Northwest Fisheries Center is currently undertaking research to integrate and synthesize these data into conceptual and, ultimately, analytical models describing the trophodynamic interrelationships of this ecosystem. The long-range objective is to develop an ecosystem model of the eastern Bering Sea which might aid in multispecies and multidisciplinary decision-making processes concerning this highly productive area.

B. Methods

This effort will operate iteratively, starting with simple models and submodels and then increasing the level of complexity as new data and detail become available. Current research efforts by the program entail (1) quantitative analysis of stomach contents of fish obtained during the 1974 Bering Sea groundfish survey; (2) synthesis of fish stomach data, inputs from pelagic fur seal studies, and pertinent literature for use in submodel definition; and (3) development of a conceptual submodel for fur seal-fish trophodynamic relationships.

The scope of the above research will be increased during FY 76 to include the definition and development of conceptual submodels for birds and marine mammals. These two additional submodels, plus the ongoing fish submodel, should provide a first approximation of the likely dynamic interactions between upper trophic level organisms in the eastern Bering Sea. These submodels should provide insight into the likely dynamic pathways through which certain adverse environmental impacts might travel in the economically valuable components of the ecosystem.

VI. INFORMATION PRODUCTS

By 30 September 1976, products of the proposed research will include the following:

1. Model description - including rationale for development, model structure, mathematical content, and parameter estimation.

2. User's guide - including program logic and flowcharts, program listing, description of input needs, sample input, and examples of runs with sample output.

3. Preliminary analysis - presenting results from computer runs undertaken for model testing.

VII. DATA OR SAMPLE EXCHANGE INTERFACES

Development of the conceptual submodel for birds will rely primarily upon pertinent literature concerning feeding behavior and trophic relationships of marine birds in the Bering Sea. The results of literature surveys undertaken by the following research units will be helpful in locating definitive publications:

239 - Ecology of Southern Hemisphere Shearwaters
339 - Literature Search on Distribution, Abundance, Behavior, and Food Dependencies of Marine Birds
341 - Feeding Ecology and Trophic Relationships in Alaskan Marine Birds
342 - Population Dynamics of Marine Birds

VIII. SAMPLE ARCHIVAL REQUIREMENTS - None

IX. SCHEDULE

A - Activity
M - Milestone (an event)

1. A July-Nov., 1975 - Analyze fish stomachs from Bering Sea

2. A July-Nov., 1975 - Review fisheries literature and historical data

3. A Dec. 1975-Feb., 1976 - Synthesize all fish information

4. M March, 1976 - Description of fish component of food web

5. M March, 1976 - Integration of inputs from NWFC pelagic fur seal studies and BLM/OCS bird studies

6. A Jan.-June, 1976 - Develop conceptual submodel for upper trophic levels

7. A March-June, 1976 - Develop input parameters for model

8. M July, 1976 - Conceptual model and input parameters available

9. A August, 1976 - Test and document model

10. M Sept., 1976 - Description of model and of preliminary tests

X. EQUIPMENT REQUIREMENTS - None

XI. LOGISTICS REQUIREMENTS - None; this is not a field-oriented activity.

WORK STATEMENT (Research Unit #83)

Title: Baseline Studies of Pribilof Island Seabirds: Bering Sea

Principal Investigator: George L. Hunt, Jr.

Geographic Area: Bering Sea

Inclusive Dates: 1 April 1975 - 31 August 1976

Cost Summary:

FY 1975	FY 1976
14,979 + 1891 = $16,870	$46,796

Proposed Research:

A. Background and Objectives

The proposed research on the reproductive success and food habits of Pribilof Island Seabirds address Task Element A-6. In addition, it is anticipated that the final report will include a comparison of the results of the present study with previous studies of Pribilof Island seabirds and with studies of food habits and reproductive success of similar species of seabirds from nearby areas (thus partially addressing Task Element A-4).

Most thorough studies of Pribilof Island seabirds are old (Palmer 1899, Preble and McAtee 1923) or concentrate on recent records of rare or unusual species (Kenyon and Phillips 1965, Sladen, 1966). However, excellent studies of seabirds in other regions provide relevant information on the reproductive ecology and foraging habits of species found in the Pribilofs (Bedard 1967, 1969a, b, Belopol'skii 1957, Fey and Cade 1959, Sergeant 1951, Swartz 1966, Tuck 1961, and Tuck and Squires 1955). Reference to these works will not only provide guidance as to what we should look for in studying the Pribilof Island seabirds, but they should also provide valuable supplementary data.

The information required to meet the objectives includes knowledge of the food habits of the various species of seabirds throughout the year and usage of foods for consumption by adults and by young. In order to properly

understand the population dynamics of these species, it is necessary to know the age of first reproduction and reproductive life span of each species, the number of eggs laid, and the number of young fledged. It is also necessary to know mortality rates for each age class and to understand causes of mortality.

The present study does not pretend to provide a complete answer to either of these questions, which could only be answered by studies of 10-20 years duration (at least in the case of population dynamics). Instead, the present study will provide preliminary estimates of reproductive success for some of the seabirds breeding on the Pribilofs and will seek to obtain samples of the foods brought to young. During the first field season our primary task will be to locate accessible nesting areas, perfect methods of capturing birds in order to obtain food samples, and develop efficient methods of sampling seabirds under the conditions imposed by the Pribilof Islands. During the second field season the number of food samples collected will be increased and efforts to determine reproductive success will be focused on those species for which reliable data can be obtained, as determined during the first field season. Since several species of seabirds nesting in the Pribilofs do not fledge their young until September or October, the results must necessarily be incomplete unless funding during the second year can be extended into the fall. The present termination of field work on 20 August 1976 is based on the understanding that a final report must be filed by 31 August 1976. Clearly, such a report can only contain the barest outline of work accomplished. Analysis of foods and reproductive data will require several months subsequent to completion of field work.

Related research on estimating populations of the Pribilof Island seabirds is planned by Dr. Joe Hickey. His data will be of great value to us in choosing research locations and in attempting to relate aspects of reproductive ecology

to historical trends in population size. Furthermore, if studies of plankton and fishes in the vicinity of the Pribilof Islands are conducted by other teams associated with this project, the data will be most valuable for assessing the degree of food selectivity demonstrated by the seabirds studied.

B. Methods

As a first step in the research program prior to the commencement of field work, pertinent literature will be searched for references to food habits, timing of reproductive activities, location of nests and other information which will facilitate maximum efficiency of data gathering in the field. Preliminary inquiries indicate that there may exist some archived bird stomach contents of relevance to the present project, but it is presently believed that these are too few in number to justify the expense of traveling to museums in order to utilize them. If sufficient material is available at either the National Marine Fisheries laboratories in Seattle or the Smithsonian Institution in Washington, D.C., supplementary funds will be sought to conduct appropriate studies.

The temporal and spatial sampling scheme will be determined by the timing of breeding and location of nest sites. Whenever possible, nests will be checked at five day intervals and the contents recorded. If the young can be reached without undue disturbance to the colony or excessive danger to the investigators, they will be weighed and the contents of their stomachs sampled. When possible, a minimum of 10 samples of foods will be obtained from each species every five days, and overall nesting success will be determined for 50 pairs. Because of the difficulty of working with these birds and because many species only lay a single egg, determination of variability within a given year may not be possible. However, if sufficient data can be obtained, comparisons between different portions of a colony within a given year will be made. Comparisons of reproductive success between years will be done.

All species of seabirds for which data can be obtained will be included in the study. The following list, based upon conversations with biologists familiar with seabirds on Saint Paul Island, provides an indication of the species present and their accessibility.

Pelagic Cormorant	Phalacocorax pelagicus	moderately available
Red-faced Cormorant	P. urile	moderately available
Black-legged Kittiwake	Rissa tridactyla	available
Red-legged Kittiwake	R. brevirostris	available
Common Murre	Uria aalge	available
Thick-billed Murre	U. lomvia	available
Horned Puffin	Fratercula corniculata	hard to reach
Tufted Puffin	Lunda cirrhata	unavailable
Crested Auklet	Aethia cristatella	hard to reach
Least Auklet	A. pusilla	moderately available
Parakeet Auklet	Cyclorrhynchas psittaccula	hard to reach

Foods brought to young will be analysed by obtaining food from the young (Hunt 1972) or from adults as they come to the nest. Samples obtained will be preserved in 70% alcohol. Identification of foods utilized will be made on the basis of comparison with taxonomic publications or, when necessary by referring specimens to specialists. Food utilization will be determined by occurrence, volume, weight, and by numbers of organisms present, when possible. For birds with inaccessible nests which bring food to their young in their bill, photographs of returning adults will be taken so that foods carried to the young may be identified.

Times of feeding of young, lengths of absence of adults, and attendance at nests will be obtained by observing the departures and arrivals of adults at their nests. Means and standard diviations of appropriate measures will be calculated when sufficient data are available.

If ship time is available, up to four at-sea surveys of seabirds should be conducted by running radial transects out from the island to a distance of 60 miles. Birds would be identified and enumerated over or track approximately 50 to 150 meters wide, depending upon the size of the bird.

Growth rates, which have proved good predictors of the probability of fledgling survival in gulls (Hunt and Hunt, MS), will be obtained whenever possible by weighing young birds at five day intervals when food samples are collected.

Reproductive success will be measured by determining the number of eggs laid, hatching success and fledging success of those species for which data can be gathered. Late nesting species (Black-legged Kittiwake, Red-legged Kittiwake, Horned Puffin, see Swartz 1966) will not have fledging success determined in 1975. In 1976, if funds are available, field work will continue until October so that data on these species can be included.

Information Products:

A. Foods

Histograms of food types on a % weight, % volume, % occurrence and % incidence will be provided for each species from which foods are obtained. Foods will be identified, when possible, to species level. It is anticipated that frequently the species or genus of food items will not be able to be determined due to advanced digestion and a more general taxonomic classification will have to be used.

B. Activity

For those species for which data are available, graphs of length of absence, timing of feeding of young and attendance of adults at nests will be presented.

C. Reproductive Success

Tables showing clutch size, hatching success and fledging success will be presented. Growth rates will be graphed and presented in tabular form and related to fledging success when possible.

Data or Sample Exchange Interfaces:

The only data required initially will be that of Dr. Hickey on numbers and location of breeding birds. Eventually I would like information on the distribution and relative abundance of food species utilized. I will need aid from appropriate specialists in identifying food species utilized by the seabirds.

Archival Requirements:

Assuming that it will be desirable to archive the contents of bird's stomachs, suitable glassware and storage space will be required. The cost of glassware and storage facilities are not included in the proposal. If the sampling is reasonably successful, we may hope to obtain between 500 and 750 samples each field season.

Schedule:

5 June-15 August 1975 - Field studies, locate appropriate nest sites, obtain food samples and data on parental attendance and reproductive success.

September 1975-March 1976 - Sample analysis, data reduction interpretation of results.

1 April 1976 - Presentation of first year report.

15 May-20 August 1976 - Field studies, continuation of first year program. If funded these field studies should continue through October 1976.

1 September 1976 - Submit revisions of first year report and summary of field activities for second year. A complete report of the second year results will be provided during a subsequent contract period.

Equipment Requirements:

No special equipment needs are anticipated at the present time other than the camera gear specified in the budget. The camera will be used to photograph birds returning with fish in their bills.

Logistics Requirements:

Transportation to and from St. Paul Island will be by commercial carriers. Transport on St. Paul will be by car and local boats. It is requested that NOAA arrange for a GSA car to be made available on St. Paul for use by the bird project between June and August 1975 and May and August 1976. In addition four radial shipbound surveys extending up to 60 miles from St. Paul would greatly enhance our knowledge of seabird distribution and foraging zones at sea. It is requested that, if ship time can be made available, that four such surveys be conducted each month.

Housing on the island will be by camping and by rented house. Reservations for use of a government house have already been made through the National Marine Fisheries Commission, Marine Mammal Division.

REFERENCES

Bedard, J. 1967. Ecological segregation among plankton feeding Alcidae. Unpubl. Ph.D. Thesis, University of British Columbia.

Bedard, J. 1969. Feeding of the least, crested, and parakeet auklets around St. Lawrence Island, Alaska. Can. J. Zool. 47: 1025-1050.

Bedard, J. 1969. The nesting of the crested, least and parakeet auklets on St. Lawrence Island, Alaska. Condor.

Belopol'skii, L. D. 1957 [Ecology of sea colony birds of the Barents Sea.] I zv. Akad. Nauk SSSR, Moskva-Leningrad (seen in Englist translation prepared by the Israel Program for Scientific Translations, Jerusalem, 1961, 346 pp.).

Fay, F. H. and T. J. Cade. 1959. An ecological analysis of the avifauna of St. Lawrence Island, Alaska. Univ. Calif. Publ. Zool. 63: 73-150.

Hunt, G. L. 1972. Influence of food distribution and human disturbance on the reproductive success of Herring Gulls. Ecology 53: 1051-1061.

Kenyon, K. W. and R. E. Phillips. 1965. Birds from the Pribilof Islands and vicinity. Auk 82: 624-635.

Palmer, W. 1899. The avifauna of the Pribilof Islands. pp. 355-432 (of pt. 3) in Jordan et al. The fur seals and fur-seal islands of the North Pacific Ocean. Washington D.C. U.S. Govt. Print. Off. Treasury Dept. Doc. 2017, 4 parts.

Preble, E. A. and W. L. McAtee. 1923. Birds and mammals of the Pribilof Islands, Alaska. North American Fauna No. 46: 1-128.

Sergeant, D. E. 1951. Ecological relationships of the guillemots Uria aalge and Uria lomvia. Proc. X Inst. Orn. Congr. Uppsala. 1950. 578-587.

Sladen, W. J. L. 1966. Additions to the avifauna of the Pribilof Islands Alaska, including five species new to North America. Auk 83: 130-135.

Swartz, L. G. 1966. Sea-cliff birds. Chapt. 23: 611-678. In: N. J. Wilimowsky and J. N. Wolfe (eds.): Environment of the Cape Thompson region, Alaska. U.S. Atomic Energy Commission, Division of Technical Information.

Tuck, L. M. 1961. The Murres. Their distribution, populations and biology. Canadian Wildlife Series. No. 1. Ottawa.

Tuck, L. M. and H. J. Squires. 1955. Food and feeding habits of Brunnick's Murre (Uria lomvia lomvia) on Akpotok Island. J. Fish. Res. Board Con. 12: 781-792.

WORK STATEMENT (Research Unit #96)

I. TITLE: Evolution and Pathobiology (including Breeding Ecology) of the Gulf of Alaska Herring Gull group (Larus argentatus x Larus glaucescens)

II. PRINCIPAL INVESTIGATOR

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III. GEOGRAPHIC AREA AND INCLUSIVE DATES

Gulf of Alaska
1 June 1975 - 30 September 1976

IV. COST SUMMARY

A. Salaries
   1. Principal Investigator
   2. Field Assistant
B. Equipment
C. Services
D. Supplies
E. Travel

TOTAL $20,000

V. PROPOSED RESEARCH

A. Background and Objectives

1. Background: The Larinae (gulls) have a world-wide distribution with 82 species, and no apparent center of origin. Birds of this sub-family are chiefly inshore feeders, and most coasts support a smaller scavenging species and a larger more piratical type (Cody, 1973). Most gulls live in flocks; they forage together the year around and nest in colonies in the breeding season. These gregarious birds nest in a wide variety of habitats ranging from vertical cliffs to open marshes. Gulls lend themselves to population analysis because of their colonial breeding tendency.

The Glaucous-winged Gull (Larus glaucescens) which breeds along the Pacific Coast from Washington State to the Aleutians, is quite closely related to the Herring Gull (L. argentatus) which is a common and widely distributed species at the southern periphery of its coastal breeding range at Glacier Bay, Alaska. The Herring Gull replaces the Glaucous-winged Gull in interior Alaska, British Columbia, and the Yukon, and interbreeds with the Glaucous-winged Gull northward along the coastline of the Gulf of Alaska. The Glaucous-winged Gull is morphologically similar to the Herring Gull except that the black pigment on the tips of the primaries is replaced by a light grey that matches the rest of the mantle. Conversely, the iris of the Glaucous-winged Gull is darker than that of the Herring Gull. These two gulls are considered separate species in the A.O.U. Checklist of North American Birds (1957), but the taxonomic and ecological relationships between the two species have not been clearly defined.

The Herring Gull and its relatives are flagrant commensals of man and their numbers have truely exploded along the coasts of this continent as the result of the availability of food in polluted waters, sewage, and urgan land-fills. It is now considered a serious pest species with implications for public health in that it distributes refuse, is a well known host of ornithosis and various parasites, and, in the case of L. glaucescens in Ketchikan, Alaska, is a proven vector of Salmonella manhattan involving human beings, untreated sewage, and municipal water supplies (Wilson and Baade, 1959).

Gulls of this group are an excellent indicator species for a decline in environmental quality. Gulls are omnivorous scavengers. Under wild conditions, gulls eat carrion, seal feces and placentae, intertidal crabs and mussels, moribund fishes, and a variety of other organisms depending upon availability. Gulls are ubiquitous and

intrusive along the coastline of the Gulf of Alaska. Their reproductive rate is high, averaging over 60 percent fledging success per year in a recent study conducted in Glacier Bay, Alaska, and they are in an exceptionally fluid state evolutionarily, with populations isolated during the Pleistocene by glaciation now freely interbreeding and producing a variety of morphological types. Given their natural propensities, gulls quickly take advantage of environmental disturbances, whether natural or human-caused. Due to their food habits and omnipresent character, gulls will quickly indicate the presence of dispersed, newly introduced petochemicals in the environment.

Base-line information should be gathered from gull populations on the coast of Alaska prior to development of oil resources. Colonies should be visited during the breeding season, and information concerning morphological, parasitic, viral, bacteriological and petrochemical conditions of a large number of uncontaminated individual gulls should be collected. Methods will include a variety of techniques, including collecting, capture, and banding of adults and young, taking of blood samples, and tracheal and cloacal swabs. Laboratory analysis will include examination of intestinal tracts for food habits and parasites, as well as examination of tissue samples (e.g. muscle, fat) for the presence of petrochemicals and organochlorides.

Oil companies are known to have options on offshore sites in proximity to coastal gull colonies. For instance, an oil company has options on offshore sites off Yakutat Bay, and owns the option on the cannery building in that village. In Yakutat Bay and immediately to the south in Dry Bay are gull colonies known personally to the investigators.

Laborabory facilities are available to Johns Hopkins investigators in Juneau, Alaska. The Commissioner of Environmental Health, State of Alaska, Dr. Francis S.L. Williamson, has a joint position with that agency and the Department of Pathobiology, School of Hygiene and Public Health, Johns Hopkins University. Dr. Williamson is personally interested in the evolution of the Herring Gull group.

2. Objectives:

Task A.4 Summarize and evaluate existing literature and unpublished data on the distribution, abundance, behavior, and food dependencies of marine birds in the study area.

There is little published information about the avifauna of southeastern Alaska. In particular the published information on marine birds is almost nonexistent. Published information about bird populations in southeastern Alaska is apparently lacking, aside from Webster's studies of Black Oystercatchers (1940, 1941, 1942), his report on altitudinal zonation of birds in southeastern Alaska (1950), and Gabrielson and Lincoln's (1959) Birds of Alaska. General information (annotated species lists) is available in

Grinnell (1909), Swarth (1911), Bailey (1927), Shortt (1939), Jewett (1943) and Webster (1950).

A number of studies have been carried out on marine birds in British Columbia by investigators from the University of British Columbia (cf. Vermeer, 1963; Drent et al, 1964; and Drent, 1965). To this date Mr. Samuel M. Patten, Jr. is the only research biologist to have completed field studies of marine bird populations in the Glacier Bay and Yakutat area. The studies were initially carried out in the field seasons of 1971, 1972, and 1973 in partial fulfillment of the requirements for the Master of Science degree at the University of Washington. Additional studies on the Gulf of Alaska coast in Glacier Bay National Monument and in the Yakutat area were carried out in 1974.

Patten and Weisbrod (1974) have reported on sympatry and interbreeding of Herring and Glaucous-winged Gulls in southeastern Alaska. There are apparently insufficient isolating mechanisms in nesting habitat selection and species recognition between these gulls in a secondary contact in a recently deglaciated area.

Williamson and Peyton (1963) published a short paper on interbreeding in gulls in the Cook Inlet region of Alaska. Other information is lacking for southern Alaska.

The family Alcidae, auks and relatives, probably evolved in the North Pacific area, since of the 23 species currently extant, 16 species are of exclusively Pacific distribution. In the 1950's there were indications of ever-increasing abundance of alcids in the North Pacific (Cade, 1959). Recently there may be indications of a decline in murrelet, auklet and petrel breeing populations on the coast of British Columbia (Nelson, pers. comm.). Pacific seabirds may have population fluctuations in natural cycles, but evidence is lacking.

Task A.5. Determine seasonal density, distribution, critical habitats, migration routes and breeding localities for the principal marine bird species in the study areas. Identify critical species particularly in regard to possible effect of oil and gas development.

A study is currently underway on the breeding ecology, including the evolution and pathobiology of the Gulf of Alaska Herring Gull group (Larus argentatus x Larus glaucescens). The initial field season on this study was completed May-August 1974. Earlier investigations were carried out on the breeding ecology of the Glaucous-winged Gull in Glacier Bay National Monument 1971-73. This current study will continue through September 1977. Research conducted 1971-73 was funded by the U.S. National Park Service, and research carried out in 1974 was supported by the Frank M. Chapman Memorial Committee and the Mae P. Smith Fund of the American Museum of Natural History.

Patten (1974) has recently completed a thesis on the breeding ecology of the Glaucous-winged Gull in Glacier Bay, Alaska. The study was conducted on the largest marine bird colony in Glacier Bay National Monument, in basically an undisturbed environment, providing valuable base-line data on gulls of the Herring Gull group (Larus argentatus x Larus glaucescens). These gulls are important scavengers, widely distributed and with a high reproductive rate. Gulls are colonizing recently deglaciated areas around Glacier Bay, the high reproductive success in the main colonies accounting for disperal of young breeding adults. The young adults are spreading to areas recently free of ice and colonizing marginal sites. The gull population in Glacier Bay certainly possesses the potential for rapid expansion.

Due to their food habits and widely distributed nature, Herring and Glaucous-winged Gulls will rapidly indicate the appearance of petrochemicals in the marine environment. In addition, because gulls nest in colonies with high numbers of individuals, the concurrent low species richness and low equitability will depress the diversity of the habitats in which they nest. Species diversity is felt by some authors (see references in Worley and Streveler, 1973) to be a measure of community stability by increasing the number and complexity of biological interactions. If it is assumed that gull colonies are avian communities, then they are not very stable habitats and hence quite susceptible to perturbation, e.g. oil spills.

An inventory of the gull colonies along the Gulf of Alaska is being compiled to determine density and distribution of this gull group. Diversity indexes are being used to assess the stability of these seabird communities. An extensive banding and color-marking program is being devised by the principal investigator under the guidance of Dr. Sladen to determine the migration routes and wintering locations of these gulls.

Task A.6 Describe population dynamics and trophic relationships of selected species at offshore and coastal study areas.

The nature of Patten's (1971-73) study was to examine the reproductive biology of several colonies of gulls on an island in the middle of Glacier Bay, Alaska. The study was carried out mainly during two consecutive breeding seasons, the first summer devoted to a general marine bird survey. Several aspects of gull breeding biology were studied for comparative purposes. Such comparative information is available in the literature for gull populations outside of Alaska and serves as a basis from which to draw conclusions. The importance of this study was to compare a pioneering gull population with previously studied and long-established populations.

The most important result of this study was data on fledging success. As can be seen from a literature review, fledging success

can serve as an index to the dynamics of an avian population. If fledging is high, one can expect a stable or expanding population. If fledging success is poor over a number of seasons, a population will decline through adult mortality and low recruitment of breeding adults.

Results from this study provided the National Park Service with specific information about the state of an animal population in an area under Park Service management. More broadly, this study indicated the reproductive potential of a pioneering gull population relatively free from human disturbance in a recently ice-free environment. Both types of information will help biologists understand the interactions between animal populations and their environment.

After the current inventory of gull colonies along the Gulf of Alaska has been compiled, the methods derived by Patten (1974) in previous research on this group will be used to gather data on fledging success in selected colony sites. The data on fledging success will provide the basis for future assessment of population changes. In conjunction with a long-term banding scheme being presently developed, life tables will be constructed to detail the age structure, mortality rates and survivorship of entire populations.

State of Knowledge: The breeding biology of gulls, especially the Herring Gull, has been studied in detail by Goethe (1937), Paludan (1951), Tinbergen (1960), Harris (1964) and Ludwig (1966). Their results consistently indicate that Herring Gulls raise an average of one young per pair per year to fledging. Extremes of variation are shown to be 0.5 by Paludan (1951) and 1.5 by Ludwig (1966) (in Kadlec and Drury, 1968). The population dynamics of the Herring Gull in eastern United States and Canada have been reasonably well investigated by Kadlec and Drury (1968). Kadlec and Drury (loc. cit.) found the usual productivity is apparently 0.8 to 1.4 young per nest in the New England Herring Gull, averaging about 50 percent fledging success. They showed this to be a major factor in the structure of the New England Herring Gull population. In a later paper (Kadlec, et al., 1969) they examined the critical period between hatching and fledging for mortality factors.

Their results indicate the average clutch size in the Herring Gull is nearly always three, and variations are small (Keith, 1966; Brown, 1967b; Paynter, 1949; Kadlec and Drury, 1968). Hatching success is usually 60 to 80 percent. Keith (1966) has discussed in detail the problems of accurately measuring success, which are due to predation of eggs and small chicks before they can be counted. Critical factors affecting hatching and fledging rate are chick and egg loss through cannibalism, chick mortality due to aggressive behavior of adults, and weather conditions during the fledging period (Paynter, 1949; Paludan, 1951; Tinbergen, 1960; Brown, 1967b).

In contrast to the intensive investigations of Herring Gulls in Europe, few workers have studied gulls along the Pacific Coast of North America. Breeding biology of the Western Gull (Larus occidentalis)

has been studied by Coulter (1969), Schreiber (1970), Harpur (1971) and Coulter, et al. (1971). Aspects of the breeding biology are similar to those of the closely related Herring Gull, but nesting habitat selection and nest materials differ because of the drier conditions on California islands.

Vermeer (1963) published a major work on the breeding biology of the Glaucous-winged Gull, although Schultz (1951) reported on growth in this species. In most aspects the Glaucous-winged Gull is similar to the Herring Gull.

Williamson and Peyton (1963) collected a series of specimens intermediate in plumage characters between the Herring Gull and the Glaucous-winged Gull from the Cook Inlet region near Anchorage, Alaska. They suggested that sympatry between breeding Herring and Glaucous-winged Gulls occurs in southeastern Alaska.

Williamson (pers. comm.) thinks that several populations of gulls may have been separated during Pleistocene glaciation; Rand (1948) suggests this may have happened repeatedly. While these gulls may have shared a common gene pool at one time, enough evolution has occurred to account for certain observed morphological differences, e.g., the amount of melanin in the mantle plumage, primary feather pigmentation, and iris color. The gulls are now expanding their ranges from Pleistocene "refuges" and where the populations are in contact, hybridization occurs. The Western Gull hybridizes with the Glaucous-winged Gull in western Washington (Bent, 1921; Scott, 1971); Ingolfsson (1970) noted Herring Gulls interbreeding with the Glaucous Gull (Larus hyperboreus) in Iceland; the Herring Gull and the Lesser Black-backed Gull (Larus fuscus) are sympatric and apparently reproductively isolated in Europe while interbreeding in Siberia (Tinbergen, 1960; Mayr, 1942; Brown, 1967a). Hybridization is apparently circumpolar (Sibley, pers. comm.).

Other important papers on gulls are those of Coulson and White (1956, 1958, 1959, 1960) on the Kittiwake (Rissa trydactyla), in which they attempt to refute Darling's (1938) contention that egg-laying synchrony in the Herring Gull and the Lesser-Black-backed Gull were related to social facilitation. Darling's (1938) hypothesis of social stimulation suggests that stimulation received from other birds in a colony produced greater synchrony of egg-laying within the colony. This in turn resulted in earlier egg-dates and a shorter spread of egg-laying in large colonies. Coulson and White (1956), however, showed that the difference in breeding times between colonies of the Kittiwake was not significant and that the spread of egg-dates increased with the size of the colony. Coulson and White (1960) observed that the greater part of the differences in time of breeding were correlated with density. They found that the spread of breeding was greatest in dense colonies of Kittiwakes, which does not support Darling's contention. Moreover, breeding occurred earlier in the more dense colonies.

Cullen (1957) reported on adaptations of the Kittiwake to cliff-nesting, which was followed by N. G. Smith's (1966a) work on adaptation to cliff-nesting in arctic gulls (Larus), and his more extensive study (1966b) on evolution in arctic gulls. Smith found four sympatric species on Baffin Island to be reproductively separated due to such isolating mechanisms as species recognition and habitat selection.

In summary one finds that the Herring Gull and its relatives in North America lay a clutch of three from which they normally fledge one young per nest per year. Predation and attacks by members of the same species are the primary factors responsible for egg and chick loss. Hybridization in the Herring Gull group occurs where populations are sympatric.

Information required: Considerable effort has been previously expended by the principal investigator to compile, summarize and evaluate existing literature on marine birds in the study area (and indeed on a world-wide scale). This literature search will continue with assistance of the Environmental Data Service.

Inventory of gull colonies along the Gulf of Alaska will continue as a completely basic part of this investigation. A large-scale banding and color-marking scheme will need to be implemented to determine critical habitats, migration routes, and seasonal density.

Data on fledging success at selected colony sites will be needed to serve as an index to the dynamics of these gull populations. Banding returns will be needed to complete life tables for analysis of population changes. Collection of adult gulls and examination of intestinal tracts will be necessary to provide further information about the trophic relationships of these omnivorous birds, as well as provide base-line data on morphology and pathobiology.

Meeting the requirements: Most of the objectives of Task A-4, to summarize and evaluate existing literature of the Herring Gull group along the Gulf of Alaska, have been achieved since this study has been underway since 1971. The information available is at hand and the principal investigator will be able to provide comparative material from Herring Gull and related populations in other areas. However, existing specific material is scanty other than the principal investigator's own work. Computer searches of the literature will be of assistance in locating additional subject matter.

Basic inventory of the important gull colonies along the Gulf of Alaska will be completed to satisfy the requirements of Task A-5 prior to the end of September 1976. However, determination of migration routes and seasonal densities requires large-scale banding returns over a number of years and the development of such information will of necessity be slow. The principal investigator is in contact with Mr. George Jonkel and Mr. Jay Sheppard of the USF&WS concerning previous banding returns for the area.

The importance of scavenging marine bird species in regards to the possible effect of oil and gas development has been previously stated.

The most important result of Task A-6 will be data on fledging success in selected colony sites. The results will contain information on gull reproductive activities during the contract seasons of 1975 and 1976 plus information obtained since 1971. This information will be considerable, and the comparative aspects of the study will provide additional amplification. Complete life table data will require further effort during successive breeding seasons, but the basic indices to gull populations will be constructed in time for the final report. Several hundred adult Herring and Glaucous-winged Gull adults will be collected and stomach contents analyzed to determine food habits and trophic relationships. This information will be obtained prior to the reporting period.

Related research: Other marine bird investigations are being conducted along the Gulf of Alaska as part of the Alaskan OCS Energy Program. While complete information about related research is not available at this time (prior to the coordination meetings), in theory several investigations seem to be allied to this proposal. Discussion should follow to complete degree and methods of coordination anticipated. The following are the proposals in which logistical and/or information coordination would be of use: Bird habitats along the Alaska coastline (Dan Timm); Interactions between Colonial Seabirds and local oceanographic conditions (William Drury); Community structure, distribution and interrelationships of Marine Birds in the Gulf of Alaska (John Weins); Photographic mapping of Seabird colonies; Literature summary; Migration; Feeding ecology; Population Dynamics; and Preliminary Catalogue of Seabird Colonies (Calvin Lensink & James Bartonek). The logistical discussions with Phil Taetz will be extremely valuable. I understand that Drs. Hickey, Hunt and Drury have considerable expertise in Herring Gull research and I will approach these researchers for additional suggestions.

B. Methods

Use of published and unpublished material: Data already collected to be used in this study are: (1) the thesis by the principal investigator on the Breeding Ecology of the Glaucous-winged Gull in Glacier Bay, Alaska (1971-73); (2) the data gathered in 1974 as part of doctoral research on the evolution of the Herring Gull group in the Glacier Bay and Yakutat areas; (3) the unpublished information on L. argentatus x glaucescens compiled by Dr. F.S.L. Williamson in the Anchorage area; (4) information on seabirds gathered by Dr. Ralph B. Williams in the Juneau area; and (5) information to be obtained on marine bird colonies in the Cordova area from discussions with Mr. Pete Islieb.

The published literature on the Herring Gull group will continue to be collected, analyzed and searched with the assistance of the Environmental Data Service.

Sampling scheme: Gull colonies are known to the principal investigator in a variety of locations in southeastern Alaska. Most colonies must be visited by small boat or light aircraft. Additional colonies will be located this summer after consultations with Dr. Williamson, Dr. Williams, Mr. Islieb and others. Adult gulls will be collected by means of set traps, drugs, or shotgun. Bird soft part colors in the orbital region, with primary feathers opposed, will be immediately photographed and noted with published color keys using the method of N.G. Smith (1966a). Permission has been requested to collect 200 adult gulls. Blood specimens will be taken via wing-vein or heart puncture according to standard procedures. Blood sera sill be frozen and prepared for examination of specific Arbo-, NDV or influenza type A viruses. The RBC cell pad will be preserved and used in other research for taxonomic analysis via the DNA hybridization method. Avian spermatozoa and/or vasa deferentia will be collected for morphological examination via standard techniques. Certain organs and tissues, e.g. liver, fat, will be examined in the laboratory for base-line evidence of petrochemicals. Stomach contents and intestinal tracts from collected gulls will be preserved for laboratory analysis of food habits and intestinal parasites.

The U.S. Fish and Wildlife Service Patuxent Research Laboratory is assisting in providing an initial 2000 Fish & Wildlife Service bands, size 6. These bands will be used on adult and juvenile gulls which will be captured and released. A color-marking scheme using a variety of dyes and patterns is being devised with the assistance of Dr. W.J.L. Sladen and Mr. Jay Sheppard, U.S. F&WS. These color patterns will be used in short-term migration studies as specified under Task A-5. Comparative behavior studies using the methods of Smith (1966, 1967) will be undertaken at selected colony sites involving changing species-specific recognition colors in the orbital region of individual gulls. Such studies could indicate the degree of isolation, or lack of it, between the Herring and Glaucous-winged Gulls.

A sample of nest sites in each colony will be examined for slope, substrate, exposure, surrounding vegetation, and distance to nearest neighbor. This information, along with calculations of species diversity, may be used to assess susceptibility to oil spills and associated environmental damage. Nest sites in selected colony areas will be marked with survey stakes and numbered florescent streamers to determine reproductive success (Patten, 1974). The number of eggs or chicks on sequential visits will be recorded for each nest site. The highest number of eggs per nest will be assumed to be the clutch size. Egg loss will be calculated at the end of the incubation period from numbers of eggs remaining from the completed clutch. Young chicks will be counted in the nest. Older chicks will be assumed to come from the nearest nest unless specific banding

information is available. At the end of the survey period, fledging counts will be made for entire colonies.

Method of analysis: Data gathered will be entered onto computer cards. For instance, SPSS or similar statistical packages will be used to test significance or differences in clutch size, hatching success and fledging success from colony to colony and from year to year (Steel and Torrie, 1960).

Taxonomic data will be obtained from the same birds that provide stomach samples. Sex and breeding condition will be obtained by dissection. Weight will be taken by a gram scale. Calipers will be used to measure tarsus, middle toe, chord of culmen, anterior nares, height of bill, total length, and chord of closed wing, and tail. Comparisons of measurements between populations will be tested using t-tests. Stomach contents will be analyzed by categories and frequency distribution. Intestinal parasites will be located by dissection and will be placed in fixative for subsequent identification. Wing hybrid indices will be constructed after the method of Ingolfsson (1970) to quantify the variation in primary feather pigmentation.

Serologic diagnosis will be based upon the presence of antibodies for specific viruses as determined by complement fixation, agglutination, and hemaglutination-inhibition tests. Tracheal and rectal swabs will be cultured. Tissue examinations will be contracted to other investigators or to a central laboratory if available.

VI. INFORMATION PRODUCTS

The products of the study conducted under this work statement will be specific data and information packages which will be included in contract reports and published material. The information packages will be of the following nature: location of the major gull colonies along the Gulf of Alaska; identification of the species present and estimation of their numbers; assessment of susceptibility to marine oil spills and associated environmental damage; measurement of reproductive success of selected colony sites prior to disturbance; examination of morphological variation leading to correct systematic placement; collection of base-line information on the state of petrochemicals currently represented in the environment by gulls of the Herring Gull group; collection of base-line data on the pathobiology of this group; comparative behavior studies; information on migration patterns and seasonal distribution; and improvement of field and laboratory techniques. Data will be prepared for submission on magnetic tape in a format approved by the project.

VII. DATA OR SAMPLE EXCHANGE INTERFACES

The following data would be appreciated from any sources: location of argentatus group colonies on GOA or associated inland lakes; identification of "species" present; estimations of their numbers; type of habitat utilized; assessment of numbers of nests; clutch sizes; reproductive success; mortality rates and causes;

feeding grounds; types of food; accessibility of colony sites and logistics required; wintering areas, migration routes and banding recoveries.

Any additional information related to the above will be welcome. In turn, I will be able to provide similar information from my own research.

I would be particularly interested if any investigator has previously researched petrochemicals present in argentatus-group gulls in the Cook Inlet region where oil wells are in operation, and if so, in which laboratory and by what methods were the specimens analyzed. Material available on petrochemicals present in other seabirds in Alaska or elsewhere would also be welcome.

I would appreciate such data if available as soon as possible after collection so that I might research suggested colony areas under discussion.

I believe my information could be of assistance to Dan Timm, William Drury, John Weins, Calvin Lensink and James Bartonek.

VIII. SAMPLE ARCHIVAL REQUIREMENTS

Gull specimens will need to be frozen as soon as possible after collection and air-mailed to the Department of Pathobiology, Johns Hopkins University, 615 North Wolfe Street, Baltimore, Maryland 21205. Such specimens need to be kept frozen until analyzed. Permission has been requested to take 200 adult gulls. We are planning to take as yet undetermined number of serum samples which will need to be treated as above. After analysis, gulls will be skinned, and be placed in the U.S. National Museum of Natural History and the American Museum of Natural History. The Department of Pathobiology, Johns Hopkins University, will maintain responsibility for the specimens until that time.

IX. SCHEDULE

This investigation will begin at Dry Bay, mouth of the Alsek River, Tongass National Forest, 75 km south of Yakutat, Alaska, on 1 June 1975 or as soon thereafter as possible. It is expected that two weeks will be spent at this important colony. Thereafter, inventory will continue northward along the GOA, after consultation with local authorities. The areas to be surveyed this summer include Icy Bay, Controller Bay, Prince William Sound and the Cook Inlet region. Schedule for these areas is flexible and will be coordinated if possible with other investigators. Specimens will be collected and colonies surveyed in these areas. Adults and young will be banded, marked and released. Analysis of data collected will be completed within 120 days after completion of the field investigation in August 1975.

The 1976 investigation will commence in April, as recommended in the (Feb., 1975) letter to Calvin Lensink, and continue through September.

X. EQUIPMENT REQUIREMENTS

Special equipment which will be needed is of the following types: Cannon net, bow nets, and inflatable boat and outboard moter. The air-transportable boat and moter are the most crucial piece of equipment to this investigation since they allow access to gull colonies in a variety of widely spread locations. The principal investigator is familiar with the use of this equipment from previous investigations. I would like to inquire if the F&WS has a cannon net (in Alaska) that could be used to capture large numbers of gulls. In addition, are bow nets available to this investigation from F&WS, or should we provide our own. Plans should be made to discuss at the Seattle meeting the use of anesthetic drugs for the capture of seabirds.

XI. LOGISTICS REQUIREMENTS

Commerical airlines will be used for transportation of the principal investigator and assistant to Yakutat, Alaska, and return to Baltimore. While in Alaska, private scheduled and chartered aircraft will be used as necessary and budgeted in the proposal. Helicopter time is not requested, nor will long-range fixed-wing survey aircraft time be recommended.

Private charter boats will be used to survey colonies located some distance from shore. It is intended that these logistics requirements be as flexible as possible due to the uninvestigated nature of the study area.

Transportation to and from Alaska will be arranged by the principal investigator through Johns Hopkins University once the contract is completed. Direct logistic support through NOAA is not currently envisioned for the 1975 field season. However, a survey of Forrester Island would be desirable in the 1976 field season if logistical support could be arranged for a number of investigators to visit the island at once.

WORK STATEMENT (Research Unit #108)

I. TITLE: Community Structure, Distribution, and Interrelationships of Marine Birds in the Gulf of Alaska

II. PRINCIPAL INVESTIGATOR: John A. Wiens
Department of Zoology
Oregon State University
Corvallis, Oregon 97330
(503-754-1105)

III. GEOGRAPHIC AREA AND INCLUSIVE DATES:

Gulf of Alaska

1 August, 1975 - 30 September, 1976

IV. COST SUMMARY:

FY 1975	FY 1976
$5,500	$33,222

V. RESEARCH OBJECTIVES, DESIGN, AND EXPECTED RESULTS

Major pertubations of marine or terrestrial environments are known often to have significant effects upon single species populations of birds. Perhaps the most conspicuous are the severe effects which concentrated oil spills may have upon some species of marine birds. Marine bird populations, however, coexist in frequently definable assemblages of species or communities which have a certain degree of structure or integration (Cody 1973; Swartz 1966; Scott 1973). We propose to investigate three major elements of community interrelationship or interdependence among marine birds in the Gulf of Alaska: (1) interrelationships of species and their role in mixed species foraging flocks, (2) the roles of migratory or transent species within the marine bird community, and (3) trophic relationships among community members. The questions we pose thus have to do not only with basic distributional patterns in space and time, but also with some elements of the complex feedback relationships which characterize marine ecosystems, and may influence their stability. We thus must consider "second order effects" in which effects on populations of some species may influence the population dynamics of other, interconnected species which are not directly affected by some environmental stress.

1) Mixed Species Foraging Flocks

It is common for many species of marine birds to aggregate into large foraging assemblages at many times during the year. The nature of flock composition suggests that some species may be to some degree dependent upon other species for initial location of concentrated food sources (schooling fishes). Observations from British Columbia, Washington and Oregon (Sealy, 1973; Hoffman, personal observation 1974 and Scott, 1973) indicate that gulls and perhaps shearwaters tend to form the nucleus for flock formation by initially locating fish schools and that various other species of diving birds are then attracted to the feeding gulls. While these latter species are probably are not totally dependent upon the former species for finding food, it is quite apparent that well-defined behavioral responses exist among these several species and that together these behavior patterns may enable many species to locate widely dispersed food resources. We propose to explore these interrelationships in several ways.

a) Characterization of mixed-species flocks. We will record the relative and absolute numbers of individuals of different species present in a flock, their relative positions, and their foraging modes. In addition, we will determine how flock composition and frequency of flock formation varies with distance offshore, with oceanographic and meterological conditions, and with geographic position within the Gulf of Alaska. Since we must determine the patterns of distribution and spatial aggregation of species to characterize flock formation, data will be gathered on seabird distributions using standard transect techniques (e.g. Scott 1973, Rotenberry and Wiens, in press).

b) Assessment of Species Interdependencies. We will note all birds observed and calculate frequencies of individuals of each species within and outside the foraging flocks, and record differences in their behavioral patterns in different flock sizes or as isolates. These observations will concentrate on recording differences in foraging tactics within and outside the flocks. For example, do large Alcids actively search for schools of fish on their own or do they generally respond to gulls or other species locating the schools? We may also explore how flock formation and species composition vary seasonally. For example, do some species enter the feeding flocks only during the breeding season? Is flock formation related to the degree of aggregation of prey resources? How is flocking behavior related to seasonal energy demands? What roles to various key species, such as gulls, shearwaters, or perhaps

fulmars play in the feeding aggregations? Finally, we may test fish school location tactics. In situations in which gulls and diving birds are present but not aggregated into foraging flocks, will baiting the gulls attract other species of diving birds?

These observations, conducted at several times during the year in a number of locations with various complexes of species, should serve to identify the relative roles of different species in flock formation and the relative importance of flock foraging to the total energy intake of various species. Thus we should obtain not only information on species interdependencies but information on the degree of aggregation of species in relation to food resource aggregations. Both sorts of information are essential to predicting the overall effects of disruptions of any single species population or any particular area within the Gulf of Alaska.

2. Role of Migrants in Community

The Gulf of Alaska supports large non-breeding populations of shearwaters, albatrosses, and other "transient" species. While these species may consume large quantities of resources during their tenure in the area, they are not so firmly tied to specific locations as are breeding individuals which must conduct their activities within some defined radius of breeding colonies. In this portion of the study we will emphasize the interactions between migratory and resident species, especially the potential "second order effects" on species numbers and population sizes. Thus, do the migrants (perhaps especially the shearwaters) feed in association with the resident species and if so do they serve as "nucleus species" in flock foramtion? What are their behavioral interactions with resident species? Are migratory species dependent upon resident species for food location? What are the relative distribution patterns of resident and migratory species? By answering such questions we hope to establish the nature of relations between species which are restricted to given areas or regions and species which occupy such areas (such as the Gulf of Alaska) only at certain times of year. It is the latter species which provide links between a region such as the Gulf of Alaska and other oceanic areas. If their populations are influenced in some way during their occupancy of the Gulf, these influences may have effects in other oceanic areas far removed.

3. Trophic Impacts of Marine Birds

Marine birds are not only linked to one another in the manners we have described but are linked to other components of the marine ecosystems, largely through their feeding functions. Since it is impossible to directly measure the magnitudes of food consumption rates in free-ranging oceanic species we must use some alternative approa One such approach is the simulation model developed by Wiens and Innis (1974). Given information on a variety of the life history attributes of several species, this model generates predictions of daily total energy demands of populations or assemblag of populations. And given information on dietary habits of the species, the energy estimates may be converted to estimates of total biomass consumption of different prey categories. In this way, we may provide tentative quantification of the trophic linkages between marine birds and their resource pools. One application of this model approach to a 4-species marine bird community along the Oregon Coast (Wiens and Scott in press) has estimated that the marine birds may consume as much as 62,500 metric to of prey per year in the Oregon Coastal zone. Northern anchovies (Engraulis mordax) comprise 43% of this total prey consumption, and of the anchovy consumption, 86% is by shearwaters which despite their status as a seasonal migrant in this region overwhelmingly dominate the total energy dynamics of the system. We will also use the model to explore trophic relationships between migrant and resident species.

The simulation model thus provides a tool through which we can obtain a clear definition of species roles in the community (a valuable supplement to the information obtained in sections 1 and 2). In addition, it provides a means for estimating the magnitude of energy linkages between marine birds and their resources, and may provide as well a means of exploring the roles of birds in nutrient cycling in marine ecosystems.

The value of a simulation model such as this is that it may be applied not only to the data that are collected during our studies but also to simulated data. In other words, we may use the model structure to examine the effects on energy flow resulting from various modifications of population densities or species compositions, not all of which are necessarily realized during our observations but some of which might be predicted to result from massive environmental disruptions. It is important to stress also the model may be an extremely useful device in indicating the importance of measuring certain variables to answer questions about energy flow, and perhaps the relative unimportance to energy dynamics of other variables which otherwise might well be measured. The model will thus serve as an important tool in defining our research design as we progress in these studies.

Elements of tasks A-4, A-5 and A-6 of the work list will be emphasized in these studies. The flock analysis will be directed at identification of species critical to the rest of the community. This will allow estimation of some of the effects of petroleum development on marine birds, beyond the initial casualties of spills. The distributional data collected will be useful for predicting areas where the risk of mortality from spills is high. The trophic impact studies will be in line with task A-6.

METHODS

A. Unpublished Data. Unpublished data will be used only for determining distributions and for selecting areas for intensive study. Some data on flock formation and structure collected by W. Hoffman on the Washington Coast in 1974 may be used to compare flock dynamics in situations with different assembla

B. Sampling Scheme.

1. Disbribution of Seabirds. Observations will be made daily in periods of at least 4 hours per observer per day. Observations will be made at all periods of the day, but proximate decisions on observation times will be largely weather and visibility dependant.

   Observations will be made as follows: the observer will place himself high on the foreward part of the ship. Observation will be limited to areas of favorable illumination. Thus if the ship is moving west at noon on a sunny day, observation will be limited to the area north of the ship's path, or one-half of the possible field of view. In inclement weather the visibility will be regularly estimated. These restrictions will facilitate quantification of bird density. The information to be collected at each sighting is listed on the attached data sheet, and the suggested data format is also presented. Formats and codings will be coordinated to maximize compatability with other bird studies.

2. Flock observations will be collected concurrently with sightings, but the field restrictions will not be operating. Whencompatible with other

Flock Record

Observers_____ Date_____
Time_____ Loc._____ Cruise_____ Flock no._____
Chronology_____
Food Source_____ Weather_____
Movement_____ Dimensions L._____ W._____ H._____

	Sp.	No.	Arriv	Depart.	U. W.	D. W.	LAT.	CENT.
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Tot.								

Assoc. Mammals:

Notes:

Observation Sheet Observers_____ ____ Ht._____

Date_____ Cruise_____ Obs. Area_____

time	Sp.	No.	Assoc.	No.Sp.	Loc	Behavior	Boat	dist. (normal)

Weather record

Time	Wind dir.	temp.	H_2O temp.	Seas	Visibility

Notes:

on-going ship usage, the ship may be directed to change course and approach an observed flock.

3. Flock formation experiments. These experiments will be conducted whenever the other research activities on the ship permit, and suitable densities of birds are present in the area. The experimental design is simple : Bait, such as galley scraps, fish chunks or popcorn will be deposited in the water off the fantail, and the ship will move off a short distance and watch. The reactions of the birds present will then be recorded.

   This experiment exploits the fact that some of the birds in the area (Gulls, Albatrosses, some Shearwaters) are facultative scavengers, but also feed extensively on the schooling baitfishes which are important to the diving birds (Alcids, Cormorants, Loons, etc.) If the bait is presented when scavengers are flying in the area of the ship, they should be attracted to it, and the reactions of the non-scavenger species can be recorded. If the non-scavengers move to join the feeding scavengers, we can conclude that they use some aspect of the foraging activity as a cue to the possible presence of food.

   The number of tests run will depend on the ship schedules and the occurrence of the proper bird species. Several non-scavengers species can be evaluated in a single test, but the scavenger species will have to be fed alone to differentiate their relative importance as cues to the non-scavenger species. Hopefully each of the commoner diving birds can be evaluated at least ten times with each scavenger (Note: the scavengers can be lumped into a few categories for testing, such as large white adult gulls, brown juvenile gulls, small gulls, dark shearwaters, etc.). Tests can be run with several scavengers at one time to test general non-scavenger response.

4. Energetics. Data on population densities and food habits of the marine birds of the Gulf of Alaska will be used as inputs in a bird energetics model of Wiens and Innis (1974). Population densities will be calculated from the distribution records. Food habits information is, or will soon be, available for most of the commoner Alcids, but is scanty for many of the Larids and Procellariiformes. These birds will be baited to stationary ships, captured on baited lines and forced to regurgitate. The bait used will be distinctive, to avoid confusion with the normal food. Food samples will be collected in all parts of the study region, and for each species analysed, an attempt will be made to sample throughout its range in the study area.

C. Sample Adequacy, Sampling Variance, and Transformations.

   Sample adequacy varies inversely with sample variace, so no a priori estimates of sample adequacy can be given. Our summer sampling scheme is designed to provide the largest possible samples within the seasonal and manpower limits.

Sampling variance in this project may be important in two areas. Considerable variance in distance estimates is to be expected between observers. This can be limited by frequent recalibration; ships radars are useful for this. However, variance can be measured to some degree by an application of Emlen's (1971) method of calculating density. This method, as adapted, consists of graphing the frequency of sightings against the distance estimates, and determining, for each observer and each common species, the observer-estimated range of identifiability. Such ranges will vary with visual acuity and with competence in identification, but major differences between individuals can be ascribed in large part to estimation errors. The other potential source of sampling error is in numbers estimation, especially in large flocks. Feeding flocks will regularly be photographed concurrently with estimation of numbers of birds present, so the estimates can be checked against counts of the birds in the photographs. No particular transformations of the data are anticipated, but whatever statistical tools are relevant may be used in the data analysis.

D. Analysis. The analysis of the distributional data will be largely descriptive and summary. Directional data may be presented graphically as in King (1970). Correlation of the distributional and directional data to weather conditions may be done using multiple regression techniques (Snedecor and Cochran 1967, Draper and Smith 1966).

The flock data can be analysed using clustering techniques (Sokal & Sneath, 1963) to distinguish flock types. Importance of flock feeding to each involved species will be determined by comparison of numbers of individuals feeding in flocks, and feeding alone. The initiation of flocks and the responsiveness of various species to small forming flocks can be explored using non-parametric order statistics (Snedecor and Cochran 1967, Ghent 1974). Analysis of stomach contents will be descriptive and summary, but overlap in foraging habits may be calculated between species using similarity indexes to compare the stomach contents.

It should be stressed that these analyses are minimal and that more extensive analysis will be undertaken when suggested by the data.

SPECIES LIST

F. Gaviidge - Loons	
Common Loon	Gavia immer
Yellow-billed Loon	G. adamsi
Arctic Loon	G. arctica
Red-throated Loon	G. stellata
F. Podicipedidae - Grebes	
Red-necked Grebe	Podiceps grisegena
Horned Grebe	P. auritus
F. Diomedeidae - Albatrosses	
Black-footed Albatross	Diomedea nigripes
Layson Albatross	D. immutabilis
F. Procellariidae - Shearwaters and Petrels	
Fulmar	Fulmarshs glacialis
Pink-footed Shearwater (?)	Puffinus creatopus
Sooty Shearwater	P. griseus
Short-tailed Shearwater	P. tenuirostris
Flesh-footed Shearwater	P. carneipes
Mottled Petrel	Pterodroma inexpectata
F. Hydrobatidae - Storm petrels	
Fork-tailed Petrel	Oceanodrema furcata
Leach's Petrel	O. leucorhoa
F. Phalacrocoracidae	
Double-crested Cormorant	Phalacrocorax auritus
Pelagic Cormorant	P. pelagicus
Red-faced Cormorant (?)	P. urile
F. Anatidae	
Common Eider	Somateria mollissima
King Eider	S. spectabilis
Steller's Eider	S. fischeri
Spectacled Eider	Polysticta stelleri
Oldsquaw	Clangula hyemalis
Black Scotor	Malanitta nigra
White-winged Scotor	M. deglandi
Surf Scotor	M. perspicillata

F. Phalaropodidae

Red Phalarope	Phalaropus fulicarius
Northern Phalarope	Lobipes lobatus

F. Stercorariidae - Jaegers and Skuas

Parasitic Jaeger	Stercorarius parasiticus
Pomarine Jaeger	S. pomarinus
Long-tailed Jaeger	S. longicaudus
Skua (?)	Catharactu skua

F. Laridae

Glaucous Gull	Larus hyperboreus
Glancous-winged Gull	L. glaucescens
Herring Gull	L. argentatus
Thayer's Gull	L. thayeri
Mew Gull	L. canus
Borapartes Gull	L. philadelphia
Sabine's Gull	Xema sabini
Black-legged Kittiwake	Rissa tridactyla
Arctic Tern	Sterna paradisaea
Aleutian Tern	S. aleutica

F. Alcidae

Common Murre	Uria aalge
Thick-billed Murre	U. lomvia
Pigeon Guillemot	Cepphus columba
Horned Puffin	Fratercula corniculata
Tufted Puffin	Lunda cirrhata
Rhinoceros Auklet (?)	Cerorhinca monocerata
Crested Auklet (?)	Aethia cristatella
Marbled Murrelet (?)	Brachyramphus marmoratus
Kittlitz's Murrelet	B. brevirostris
Ancient Murrelet	Synthliboramphus antiquus
Parakeet Auklet	Cyclorrhynchus psittacula
Cassin's Auklet	Ptychoramphus aleuticus

EnergeticsStudies will concentrate on members of the following families: Laridae, Phalacrocoracidae, Procellariidae, Diomedeidae

VI. INFORMATION PRODUCTS

A. Distribution Report: To be done in coordination with all other researchers involved in seabird studies in the region and in the program.

Content: Summaries of all sightings of birds in the area, with estimates of density, absolute abundance, range and seasonal distribution patterns for all species.

Format: Prepared by species, in format suitable for publication in Ornithological journals. The format used by King (1970) for similar data may be followed. This could be presented as one large report, or as a series of smaller papers, broken down perhaps by family.

B. Flocking and Flock Interations.

Content:

(1) Quantitative assessment of the role(s) of each participating species in feeding flocks, a determination of the importance of flock foraging to each species, and an assessment of the importance of each species to the successful foraging of other flock species.

(2) Roles of migrant versus breeding or resident species in flock formation and structure.

(3) Flock formation and structure - cues used in food location by flocki species, order of species arrival, three-dimensional flock structure, in terms of species roles.

(4) Relations of flock dynamics to spatial and temporal variations in the physical and biotic environments, with special reference to prey resource levels.

Format: Written in monograph form, or as a series of smaller articles in format suitable for publication in appropriate scientific journals.

C. Trophic Impact and Energetics

(1) A "data paper" (or papers) analysing food habits of Gulls, Shearwaters, etc. from stomach sample analysis and feeding observation.

(2) Results of computer simulation analysis and exercises
Content: Results of application of Weins - Innis BIRD program to the Seabird distributional and food habits data.
Format: Suitable for inclusion in the series produced from this simulation model; to appear in a suitable scientific journal.

NOTES:

1) In each of these manuscripts, critical areas of inadequate knowledge will be discussed and accompanied with appropriate recommendations.
2) Data summarizations, analyses, and accompanying narratives will be supplied in a format suitable for magnetic tape archiving by the project.
3) Quarterly reports of activities will be provided, within the time constraints of field studies.

VII. Data or Sample Exchange Interfaces

Summarized results or raw data on bird distributions, both offshore and on colonies, from summer 1975 will be needed by December 1, 1975 for planning of the summer 1976 schedule. We will require continuing access to these and to our own data for statistical analyses.

Any key to forage fishes devised under task A-16 will be needed, preferably by May 1, 1976.

Weather and current data collected by the ships while bird observations are being made will be required, preferably on a daily basis. Specific measurements needed are continuous or frequent air temperature, wind speed and direction, surface water temperature, and salinity as well as the features listed on the attached data forms. Frequent (several times per day) locational fixes will also be required on all cruises while observing. Biotic data will be required on plankton, fish, and crustacean densities from sample areas, and on marine bird densities at breeding colonies and elsewhere.

Bibliographic search services will be required for a review of seabird distribution and flock dynamics.

VIII. Sample Archival Requirements

Data from this study will be supplied in a form ready for keypunching. Further preparation of this material for archiving will be the responsibility of central offices. Our group will analyze samples and conduct statistical analyses of data, provided budget additions are approved.

IX. SCHEDULE

August 1 - September 30, 1975 - Collection of distributional and flock data as per attached methods sections. The cruise itinerary will not be critial in this phase.

Capture and regurgitation techniques will also be worked out during this period.

For most of this period there will be two observers in the area, spending approximately 3 weeks out of each month on separate boats, and one week out of each month together. In September, one short cruise (4-7 days) with three observers will be required.

September 30 - December 1, 1975 - Compilation and entry into EDS of 1975 Data Distributional and preliminary flock analysis.

December 1, 1975 - Delivery of preliminary distributional report.

November 15 - December 25, 1975 - Two cruises of 7 - 10 days during this period to examine winter association patterns: one observer per cruise.

January 1 - February 1, 1976 - Continued analysis of 1975 data and formation of 1976 season cruise schedule.

Distributional data from all observers for this region will be needed to help locate areas of special interest for 1976 season.

February 1 - March 10, 1976 - Two cruises of 10 - 15 days duration, preferably in an area not covered during the November - December cruise. One observer per cruise.

March 10 - May 1, 1976 - Analysis of winter data and entry of data into the EDS.

May 1, 1976 - Delivery of interim report summarizing winter distribution data.

May 1 - September 30, 1976 - Data collection as follows:

During each month May - July 18 days of cruise time will be needed simultaneously on two ships, covering between them all areas of the GOA study region, including areas identified from the 1975 data and the literature as areas of concentration, and including areas of lesser concentration. These cruises should include time both inshore and offshore to outer shelf depths in all regions and in all months. During August and September, the schedule will be similar but coverage may be biased in favor of areas inadequately covered in 1975.

Also, for 10 days per month, a smaller (35-80 foot) boat will be needed for more intensive work on flock structure and food habits analysis. We will need primary control of the scheduling of this boat. A chartered commercial fishing boat might be appropriate.

October 1 — Preparation of final reports and papers.

XI. LOGISTICS REQUIREMENTS

Berths on major vessels will be required as indicated in the attached schedule. While under way, we will need control of small scale ship movements, such as temporary stops and small course deviations to approach concentrations of birds, and to conduct flock formation experiments. Recognizing that some research to be conducted on the ships may be disrupted by frequent stops, we are willing to restrict our control to a minimum of four hours per day, with the hours to be arranged one day in advance. Suitable observation posts, with cover for inclement weather, are needed high on the foreward part of the ships, preferrably in the region of the bridge. Access to the bridge for radar calibration of distance estimation will be needed. Minimal indoor lab space for sample treatment and storage will be needed.

As noted in the schedule, use of a smaller boat, such as a chartered commercial fishing boat of perhaps 35 to 80 feet, will be required for ten days per month from May - September, 1976. Specifications are: the boat must be equipped with radar and an accurate locational navigation system (preferably LORAN), a recording wind gauge, surface water temperature recorder, and must have a relatively low stern deck.

NOTE: These 10 day/month periods may be provided by NOAA ships, chartered vessels, or a combination of these. If desired, we will arrange for charter of suitable vessels with funds provided by the project. No such funds are included in the proposed budget.

REFERENCES

Cody, M.L. 1973. Coexistence, coevolution and convergent evolution in seabird communities. Ecology 54: 31-44.

Draper, N. and H. Smith. 1966. Applied Regression Analysis. John Wiley and Sons. New York. 407 pp.

Emlen, J.T. 1971. Population densities of birds derived from transect counts. Auk 88: 323-342.

Ghent, A.W. 1974. Theory and application of some nonparametric statistics II. Normal approximations to the Wilcoxon two-sample and paired sample tests, and two related tests. The Biologist 56: 1-31.

King, W.B. 1970. The trade-wind zone oceanography pilot study part VII; Observations of sea birds March 1964 to June 1965. Special Scientific Report-Fisheries No. 586.

Rotenberry, J.T. and J.A. Wiens. in press. A method for estimating species dispersion from transect data. Amer. Midl. Natur.

Scott, J.M. 1973. Resource allocation in four syntopic species of marine diving birds. Ph.D. Thesis, Oregon State University, Corvallis.

Sealy, S.A. 1973. Interspecific feeding assemblages of marine birds off British Columbia. Auk, 90: 796-802.

Swartz, L.A. 1966. Sea-cliff birds, p. 611-678. In N.J. Wilimousky and J.N. Wolfeled, Environment of the Cape Thompson region, Alaska. U.S. Atomic Energy Commissions, Div. Tech. Information. Washington, D.C.

Snedecor, G.W. and W.G. Cochran, 1967. Statistical Methods. Iowa State Univ. Press, Ames, Iowa. 593 pp.

Sokal, R.R. and P.H.A. Sneath. 1963. Principles of Numerical Taxonomy. W.H. Freeman and Sons, San Francisco, 359 pp.

Wiens, J.A. and G.S. Innis. 1974. Estimation of energy flow in bird communities: A population bioenergetics model. Ecology 55: 730-746.

WORK STATEMENT (Research Unit #172)

I. Title: Shorebird Dependence on Arctic Littoral Habitats

II. Principal Investigator: Dr. R. W. Risebrough
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Bodega Marine Laboratory
University of California

Research Coordinator : Dr. Peter G. Connors
Assistant Research Ecologist
Bodega Marine Laboratory
P.O. Box 247
Bodega Bay, California 94923
Telephone (707) 875-3511

III. Area and Dates: Beaufort Sea
May 15, 1975 to September 30, 1975
May 15, 1976 to September 30, 1976

IV. Cost Summary: FY 1975: 8,351.93 plus logistics
FY 1976: 23,844.33 plus logistics

V. Proposed Research: A. Background and objectives

- Tasks A-5 and A-6 of primary emphasis; Task A-4 of secondary emphasis.

- Considerable effort has been expended on studies of the ecology of tundra nesting shorebirds near Barrow, Alaska (see Appendix A, relevant references). These studies have dealt almost exclusively with conditions on the upland tundra, primarily during the short arctic breeding season. It has been noted, at Barrow and elsewhere in the arctic, that densities of several species of shorebirds increase near the shoreline as the summer progresses, with a net shift in foraging effort toward increased use of littoral habitats. This movement begins with non-breeders and is augmented progressively by a net shoreward movement of local and also inland birds, especially after the young have

fledged. However, the importance of this habitat shift in the breeding cycle of arctic shorebirds has not been adequately assessed.

- In order to understand the possible effects of offshore oil development on tundra shorebirds, we must determine the dependence of species on littoral habitats throughout the summer season. This requires investigation of the distribution of individuals in different shore and near-shore habitats as breeding activity and habitat availability and preferences change through the season. Thus, we need information on these topics, followed seasonally:

    (1) Species density in various shoreline habitats
    (2) Species dispersion patterns and behavior determining those patterns
    (3) Species microhabitat preferences
    (4) Microhabitat dispersion and relative abundance
    (5) Major invertebrate prey identification and relative abundance
    (6) Related density, dispersion, habitat preferences and prey items during breeding on adjacent upland tundra

- Topics (1) and (2) will receive the major effort in our study, and we anticipate acquiring sufficient data to draw meaningful conclusions with some generality. Topics (3) and (4) are also important for proper interpretation, but extensive data require time-consuming measurements. The extent of this aspect of the study will be determined by logistics problems and time available in the field. We expect coverage of this question to be sufficient. Topic (5) can be treated only qualitatively, since quantitative, reliable sampling of invertebrate populations would require a separate study. Useful data may be available from Dr. Carter Broad's littoral surveys. This coordination will be pursued. Topic (6), essential for comparison and proper interpretation, will be treated principally from published reports and from data acquired in another concurrent study, described below.

- A related study, investigating density and dispersion of shorebird nests in relation to dispersion of preferred foraging microhabitat, is planned for Barrow concurrently with this one. Final approval of funding from ERDA is still pending (F.A. Pitelka, principal investigator). The design of both studies has been coordinated. Although each project can succeed independently of the other, many sampling procedures have been standardized to facilitate comparison of results.

V. B. Methods

- Useful correlative data from external sources exist concerning two questions of relevance:

(1) What is the annual variation in shorebird breeding at Barrow, with respect to dates of nesting, nesting densities, and success rates, by species? Knowledge of this is helpful in evaluating the generality of results gathered in only two seasons. Information is available to approach this question from published sources (see appendix A) and from unpublished data of F. A. Pitelka, covering a total of 16 seasons. These sources will provide an estimate of the variation.

(2) What is the schedule of southward migration of arctic shorebirds? Dates of arrival of tundra nesters on southward migration at many locations in North America are published. Many of these will be checked to aid in estimating the duration of post-breeding use of tundra and arctic littoral habitats by species.

- Shorebird census data: In each area, transects will be established for sampling shorebird distribution within different shoreline landforms.

It must be emphasized that methodology may require adjustment in the field to optimize the return in useful information for time expended. This outline presents our most probable approach.

First, we will sample the shorebird densities within a variety of littoral habitats along designated sampling routes. These

routes will be transects following the shorelines, 1 km in length, divided into 40 contiguous 25 m subunits. Width of census plots will vary between habitats and within habitats seasonally, and will be recorded with each census. Plots will extend beyond the water's edge, a constant distance (to be determined) to include habitat used especially by phalaropes. Transects will be marked by stakes and will be followed through the season, as discussed below.

In addition, two linear transects, .5 km in length and divided into 20 contiguous 25 m x 25 m subunits, will be established, abutting the littoral zone within each littoral transect and extending in an approximately perpendicular direction across adjacent tundra.

The intensive effort will be expended at Barrow, where 6 sets of census transects are anticipated, in these habitats: open lagoon beach (Elson Lagoon); lagoon estuary (Central Marsh Slough); ocean beach (near Nunavak Bay); ocean estuary (Nunavak Bay); closed brackish lagoon (North Salt Lagoon); and sand spit (on Point Barrow). Some adjustment of transect lengths and locations will be dictated by the local topography at some sites. At Wainwright and Cape Halkett, similar transect sampling will provide basic comparative data in order to allow some assessment of the generality of the Barrow results. From 3 to 6 sets of transects are anticipated at each of these sites.

Censuses at Barrow will be taken periodically throughout the season from approximately June 20 to September 10. Our goal will be to census birds two to four times per census day to consider diurnal variation, with one census day about every 10 days. Wainwright and Cape Halkett will be visited either two or three times each summer, with two to four censuses per transect per visit.

To the extent that time permits, observations of social behavior (flocking, agression, territoriality) will be made in all habitats throughout the season to aid in interpreting the census data. It seems likely that social systems influence the dispersion of individuals within habitats, and interactions may be quite different from those in the nesting situation.

We regard this proposed sampling scheme as a compromise between the requirements of reliability of population estimates, dictating large census plots and a large number of censuses, and of generality of results, dictating many census plots in different habitats and different geographic areas. The limiting factor is, of course, time. This sampling scheme represents an attempt to balance these needs, and to retain equivalency of census plot areas for comparative purposes.

For microhabitat measurements, two methods have been devised. For species preference information, measurements of these variables are made at the location of a randomly chosen individual, on a 10-cm radius circle: (1) average water depth, (2) distance to nearest water, (3) substrate surface composition (mud, sand, water, plants, ice), (4) penetrability, (5) grain size, (6) vegetation height density. For habitat availability, census plots will be sampled with a 1 m^2 grid for similar variables.

Measurements will be taken for at least 20 individuals of as many common species as time permits. These determinations should be repeated through the season, probably once every 20 days. During the same times, habitat availability within littoral and adjacent tundra transects will be sampled with about 40 randomly placed sites within each transect.

Major invertebrate prey items will be sampled in littoral areas where shorebirds are feeding. In some cases, observation of foraging birds, followed by substrate sampling, can identify prominent prey species. Samples will be collected with cores of different depths (5 mm to 70 mm). Multiple samples of pooled cores will allow qualitative estimates of the relative abundance of major invertebrate prey. Samples will be washed through 2-mm, 1-mm, and .5-mm mesh screens, sorted, and preserved.

- Shorebirds (sandpipers, plovers, and related types) comprise a major segment of the coastal avifauna of the Beaufort Sea area, contributing nine regular and seven irregular breeders to the Barrow community, as follows (Pitelka, 1974): Regular breeders: American Golden Plover, Ruddy Turnstone, Pectoral Sandpiper, White-rumped Sandpiper, Baird Sandpiper, Dunlin, Semipalmated Sandpiper, Western Sandpiper, and Red Phalarope. Irregular breeders: Semipalmated Plover, Red Knot, Curlew Sandpiper, Long-billed Dowitcher, Sanderling, Buff-breasted Sandpiper, and Northern Phalarope. Seventeen other species of shorebirds have been recorded at Barrow as migrants or occasional visitors.

  These species will be considered of primary interest, but all non-passerine birds within census plots will be recorded.

- Census data will be analyzed for mean population densities, by species, and correlation with season. Since common species can be expected to exhibit a seasonal population peak, a second order polynomial regression can identify the date of peak abundance. Data are collected in small (25 m) subunits to determine dispersion of individuals, an important aspect of the social system (resource utilization system) of the birds. Several indices are available, such as that derived by Lloyd (1967. Mean crowding. J. Anim. Ecol., 47:607-613).

Microhabitat samples within transects will also be subjected to analysis of dispersion, since this may be an important factor in determining dispersion of birds. They will also provide estimates of availability of habitat types within each transect for correlational analysis (non-parametric Spearman's rank correlation) with species densities.

Microhabitat preference data will be analyzed by applying a discriminate function analysis to the microhabitat variables measured for each species. This procedure weights the different variables in such a fashion as to maximally separate the species along new axes which are functions of the measured variables. Microhabitat preference data derived on this fine scale will be compared with the correlation between species density and habitat type on the more general scale described above, to aid in assessment of the importance of littoral habitats to different species.

VI. Information Products:

The basic information products to be derived are these: (1) Detailed censuses of shorebird densities by species and by habitat through the season; (2) Microhabitat preference data by species through the season; (3) From these basic data, and additional observational data on behavior and foraging ecology,

together with analysis already described; a series of estimates of the importance of littoral habitats to shorebird species.

VII. Data Exchange:

The following data from other investigators will be helpful:

(1) Any census data for birds in the Barrow area, including offshore counts. These will be of interest primarily because we expect to census all non-passerine species in our shoreline transects.

(2) Weather information for Barrow throughout the season.

(3) Any invertebrate population data for littoral areas in the Beaufort sea region.

We are not aware of other investigators who will need our data before the research and interpretation is completed. Data will be delivered for archival purposes on magnetic tape in the format prescribed by project data management instructions.

VIII. Sample Archival Requirements:

A small number of bird specimens may be preserved if specimens become available; these will be returned to the Museum of Vertebrate Zoology, University of California, Berkeley. Invertebrates collected will be preserved in 70% ethanol and returned to the Bodega Marine Laboratory. Expected number of samples is less than 100.

IX. Schedule:

Invertebrate prey samples will be taken approximately three times per season in most habitats studied. Since sampling along different

transects will be staggered, samples will be taken almost continuously from June 20 to September 10.

Census data and microhabitat measurements will also be taken continuously over the same period. Preliminary analysis after summer 1975 will allow reappraisal of the sampling scheme for 1976. Final analysis of all data will not be possible until September 1, 1976.

X. Equipment:

None anticipated.

XI. Logistics:

A. Summer 1975. Most 1975 charges at NARL are included in the FY 1975 logistics budget, as instructed.

(1) Full support at NARL is required, as follows:

For	1 person	May 30 - June 22:	24 days
	1 person	June 5 - September 4:	92 days
	1 person	June 15 - September 15:	93 days
	1 person	June 15 - August 15:	61 days

Total: 270 person-days

together with analysis already described; a series of estimates

Room and board 270 x 13.00 per day	3,510.00
Clothing 270 x 2.00 per day	540.00
Small laboratory 109 days x 5.00 per day	545.00
Vehicle 80 days x 24.00 per day	1,920.00
Shop and transect marking materials	155.00
Total	6,670.00

(2) Fixed-wing aircraft from Barrow to Cape Halkett and Wainwright: approximately two trips each station, total four trips [approximate cost: $85 per hour (Cessna)]. Two hours per trip. These trips, originally planned for late June, will be more useful about July 1-4 and July 5-8. Order of these trips is flexible, but should remain consistent in subsequent trips.

(3) Space and living support for 2 persons, 4 days each visit, at Cape Halkett and Wainwright. Total 16 person days away from NARL. Same dates, approximately July 1-4 and July 5-8. Note that NARL room and board has been included for these periods also. A vehicle

may be necessary to reach suitable census transects within Wainwright and Cape Halkett areas.

- Late Summer 1975: Charges for these airplane trips and support at Wainwright and Cape Halkett have been included with the FY 1976 logistics budget.

  Trips and support as in (2) and (3) above for 8 aircraft trips, same stations. Dates approximately July 30 - August 1, August 2-4, and August 26-28, August 29-31.

- Note that support away from NARL for these visits requires only 3 days per visit. Total 24 person days. Vehicle as before, if available.

B. Summer 1976

(1) At NARL

For 1 person	June 1 - June 22:	22 days
1 person	June 10 - September 3:	86 days
1 person	June 18 - September 15:	90 days
1 person	June 16 - August 15:	60 days

Total: 258 person-days

Room and board 258 x 13.00 per person-day	3,354.00
Clothing 258 x 2.00 per person-day	516.00
Small laboratory 100 days x 5.00 per day	500.00
Vehicle 75 days x 24.00 per day	1,800.00
Total	6,170.00

(2) Aircraft (as above), total 12 trips

Approximate dates as in 1975.

(3) Space and support for 2 persons each visit to Cape Halkett and Wainwright, as in 1975. Total 40 person-days. Approximate dates as in 1975. Vehicle as before, if available. Logistic support for all these requirements is requested directly from NOAA. Funds have not been included in the University of California budget to cover these costs.

APPENDIX A

PUBLISHED PAPERS DEALING WITH SHOREBIRD ECOLOGY NEAR BARROW, ALASKA

Holmes, R. T. 1966a Breeding ecology and annual cycle adaptations of the red-backed sandpiper (Calidris alpina) in northern Alaska. Condor, 68:3-46.

Holmes, R. T. 1966b Feeding ecology of the red-backed sandpiper (Calidris alpina) in arctic Alaska. Ecol., 47:32-45.

Holmes, R. T. 1966c Molt cycle of the red-backed sandpiper (Calidris alpina) in western North America. Auk, 83:517-533.

Holmes, R. T. 1970 Differences in population density, territoriality, and food supply of dunlin on arctic and subarctic tundra. Symp. British Ecol. Soc., 10:303-319.

Holmes, R. T. 1971 Latitudinal differences in breeding and molt schedules of Alaskan red-backed sandpipers (Calidris alpina). Condor, 73: 93-99.

Holmes, R. T. and F. A. Pitelka 1964 Breeding behavior and taxonomic relationships of the curlew sandpiper. Auk, 81:362-379.

Holmes, R. T. and F. A. Pitelka 1968 Food overlap among co-existing sandpipers on northern Alaskan tundra. Syst. Zool., 17:305-318.

MacLean, S. F., Jr. 1969 Ecological determinants of species diversity of arctic sandpipers near Barrow, Alaska. Ph.D. thesis, Univ. of California, Berkeley.

MacLean, S. F., Jr. 1974 Lemming bones as a source of calcium for arctic sandpipers (Calidris spp.). Ibis, 116:552-557.

MacLean, S. F., Jr. and R. T. Holmes. 1971 Bill lengths, wintering areas, and taxonomy of North American dunlins, Calidris alpina. Auk, 88:839-901.

MacLean, S. F., Jr. and F. A. Pitelka. 1971 Seasonal patterns of abundance of tundra arthropods near Barrow. Arctic, 24:19-40.

Pitelka, F. A. 1959 Numbers, breeding schedule and territoriality in pectoral sandpipers of northern Alaska. Condor, 61:233-264.

Pitelka, F. A. 1974 An avifaunal review for the Barrow region and north slope of arctic Alaska. Arctic and Alpine Res., 6:161-184.

Pitelka, F. A., R. T. Holmes, and S. F. MacLean, Jr. 1974 Ecology and evolution of social organization in arctic sandpipers. Amer. Zool., 14 :185-204.

ALASKA MARINE ENVIRONMENTAL ASSESSMENT PROGRAM
WORK STATEMENT (Research Unit #215)

I. TITLE: Avifaunal utilization of the offshore island area near Prudhoe Bay, Alaska.

II. PRINCIPAL INVESTIGATOR:

George Mueller, Director
Marine Sorting Center
Institute of Marine Science
University of Alaska
Fairbanks, Alaska 99701
SS#: 534-40-9671

III. GEOGRAPHIC AREA AND INCLUSIVE DATES: Beaufort Sea
1 Apr 75 - 30 June 76

IV. COST SUMMARY:

FY 1975 through June 30, 1975	FY 1976 July 1, 1975 through Sept 30, 1976
	$3,944

V. PROPOSED RESEARCH:

A. Background and objectives:

The main objectives of the present study are to document: 1) seasonal numerical changes by species and sex, 2) daily and seasonal trends in spatial distribution, by species and sex, and 3) diurnal activity rhythms, by species and sex.

This project falls under task A-5 of the proposed research list. Although some work has been accomplished concerning eiders migrating along the Beaufort Sea coast of Alaska (Thompson and Person 1963; Johnson 1971; Flock 1973), only one known study has dealt with the bird utilization of the offshore islands (Schamel 1974). Bartels (1973) reported aerial surveys along the Beaufort Coast.

All information needed to complete my task was collected during the summer of 1972. These data have been punched onto IBM cards and are currently stored on computer tape.

A finished copy of my findings will be available by 30 September 1976. This includes tables, graphs, and conclusions.

The ARCO project, "Migratory bird use of Beaufort Sea barrier islands and associated lagoons" is certainly related to my project. I will be available to Dr. Timm for consultation and advice on this project.

B. Methods

Early in the season, 12 June through 22 June, counts were taken at regular intervals with the use of a spotting scope. The first counts were made ar half-hour intervals. Due to the increasing amount of time required to census the increasing numbers of birds, the interval was lengthened to one hour and finally two hours.

From 12 June through 22 June, counts were taken on rotating 8-hour shifts, as follows: 0800-1600, 0000-0800, and 1600-2400. The count required two individuals: one observed and dictated while the other recorded the information on data sheets. After 22 June, the nesting activities of the eiders required almost full time attention. Censuses were limited to bi-weekly counts (or sometimes even more, depending upon weather conditions and eider activities on the island). Observations were made with a 20X spotting scope from an elevated blind. I have 84 hours of census and activity data stored on computer tape. These data were gathered from 12 June through 7 August.

During the censuses, we recorded 28 species of birds. These birds comprised 5 Orders: Gaviiformes (Gaviidae), Anseriformes (Anserinae, Aythyinae, Merginae), Charadriiformes (Charadriidae, Scolopacidae, Phalaropodidae, Stercorariidae, Laridae, Alcidae), Strigiformes (Strigidae), and Passeriformes. Those birds which are ubiquitous throughout the season will receive the most attention in analysis.

At present, I intend to analyse my information only by graphical means. During my intensive consuming period, I may have sufficient replicate samples to attempt an Analysis of Variance on temporal and spatial differences. Graphical analysis will allow me to "feel out" whether this would be worthwhile.

VI. INFORMATION PRODUCTS

I would like to publish a small paper at the conclusion of this project. It would concern the avifaunal utilization of the offshore island area and would have the following format: Introduction, Study Area, Methods, Results and Discussion, Overview, and Literature Cited. It will basically be a series of graphs and tables accompanied by interpretation and substantiated, when possible, with comparative studies.

VII. DATA OR SAMPLE INTERFACES

I would like to compare my results with those to be gathered by ADF&G this and next summer.

VIII. SAMPLE ARCHIVAL REQUIREMENTS

None anticipated.

IX. SCHEDULE

All sample acquisition has already occurred. I will have a finished report ready by 30 September 1976.

A data interface exists with ADF&G, regarding both the numbers of birds and the evaluation of critical habitat.

X. EQUIPMENT REQUIREMENTS

None.

XI. LOGISTICS REQUIREMENTS

None.

XIII. LITERATURE CITED

Flock, W.L. 1973. Radar observations of bird movements along the Arctic coast of Alaska. Wilson Bulletin 85(3): 259-275.

Johnson, L.L. 1971. The migration, harvest, and importance of waterfowl at Barrow, Alaska. M.S. Thesis. Univ. of Alaska. Fairbanks, Alaska. 87 p.

Thompson, D.Q. and R.A. Person. 1963. The eider pass at Point Barrow, Alaska. Journal of Wildlife Management 27(3): 348-356.

Bartels, R.C. 1973. Bird survey techniques on Alaska's north coast. M.S. Thesis. Iowa State Univ.

Schamel, D.L. 1974. The breeding biology of the Pacific Eider (Somateria mollissima v-nigra Bonaparte) on a barrier island in the Beaufort Sea, Alaska. M.S. Thesis. Univ. of Alaska. 95 p.

WORK STATEMENT (Research Unit #237, 238)

SUBMITTED TO: National Oceanic and Atmospheric Administration
U. S. Department of Commerce
Environmental Research Laboratories
Boulder, Colorado 80302

I. TITLE: Birds of Coastal Habitats on the South Shore of Seward Peninsula

II. PRINCIPAL INVESTIGATOR: William H. Drury
Massachusetts Audubon Society
Lincoln, Massachusetts 01773

III. GEOGRAPHIC AREA AND INCLUSIVE DATES: Northern Bering Sea
May 20, 1975 -- June 30, 1975
July 1, 1975 -- Sept. 30, 1976

IV. COST SUMMARY:

FY 1975 through June 30, 1975	FY 1976 July 1, 1975 -- Sept. 30, 1976
$10, 490	$64,045

V. PROPOSED RESEARCH

A. Background and objectives

1. Background

Ocean currents are among the major features of the lives of seabirds because they bring to the feeding areas the nutrients which support the seabirds food. One begins by assuming that the reproductive success of birds in a colony is influenced by the food available within effective feeding range (Lack 1954) and that in a static situation the food available would be depleted in the course of a breeding season (Ashmole & Ashmole 1967). If, however, ocean currents continuously change the water mass available to a breeding colony, new supplies of food are paraded past throughout the breeding season. Therefore one expects that the largest, most successful and most persistent seabird colonies will be located near ocean currents and that they will therefore be vulnerable to oil which might get into those currents.

2. Objectives

a) To review published and unpublished reports (A-4) to learn what is known on the distribution, abundance and food dependencies of marine birds in the Norton Sound area, Bering Sea and Chukchi Sea areas of Alaska.

b) The major focus of this program is (A-5):

i) At seabird colonies at Bluff and Sledge Island:
to identify the species and numbers of breeding seabirds,
to record daily, monthly and yearly changes,
to describe local schedule of breeding and approximate limits of variation,
to measure reproductive success and differences between colonies and between years,

to measure the times that individual birds are absent on feeding trips and if possible collect data on the number and frequency of feeds,

to collect samples of food in order to identify species and numbers of prey items

ii) If facilities are available on feeding grounds near the colonies to identify how far the birds fly for food, where they concentrate and how these activite change with the season and differ among the species and colonies.

iii) Between seabird colonies to identify the species components, their numbers and reproductive performance of seabirds at Sledge Island and Bluff. These data will be used for comparison with data other seabird colonies in the region such as at Cape Denbigh, King Island, the York Mountains-Cape Wales area, and those on St. Lawrence Island.

iv) To survey sample coastal areas and lagoons for waterfowl gatherings

to identify species and count their numbers, recording changes during the season,

to identify why gatherings occur whether feeding or resting on migration, and feeding and resting during the breeding season, or movements relative to tides and storms.

c) (Part of A-6). To describe some aspects of the dynamics and trophic relations of the selected species. This work will depend upon data gathered in fisheries and oceanographic studies (such as portions of tasks A-8, A-15 and A-23)

to locate the distribution and abundance of prey species and associate the seabird feeding patterns with them,

to identify the factors that contribute to local productivity and to the ways in which resources are paraded past the colony.

d) These studies will assemble the data from relevant studies to address aspects of

i) task B-2 to determine the impact of circulation patterns of ocean currents in carrying oil pollutants to seabird colonies and feeding areas,

ii) task C-4 to predict from knowledge of reproductive rates and additional data on age structure and mortality rates (when they become available) the rate at which some marine bird species can be expected to recover their numbers after die-offs resulting from contamination or disturbance of breeding habitats.

These studies will contribute conceptual materials and some quantitative data to be used by those developing ecosystem models (Task E-1) to predict environmental effects of proposed mineral development.

3. Present state of knowledge

Some studies of the breeding biology and food of Kittiwakes, Common and Thick-billed Murres, Horned Puffins, Least, Crested and Parakeet Auklets have been made. Much more detailed knowledge is available on Kittiwakes (Coulson, et al.) and Murres (Tuck, Belopolski, Uspenski) than the other species. An approximate schedule of breeding activities and breeding performance is known, but detailed local information is necessary for comparative purposes. Some studies (Bédard and Swartz) have already examined the food of some of the species involved on St. Lawrence Island and at Cape Thompson north of Kotzebue Sound. Oceanographic

studies have been carried on in the northern Bering Sea, the Bering Strait and the southern Chukchi Sea. Studies of planktonic fisheries (Herring and Swall Salmon) have been carried out in Norton Sound. These studies have contributed preliminary information on the distribution and density of some of the fish and plankton. Published articles suggest tht there are good correlations between these biological features and the characteristics of water masses and ocean currents.

It is important to relate the distribution and abundance of seabirds and waterfowl of this region to the patchy patterns of food supply and suitable breeding sites, e.g. the relative abundance of Crested Auklets, Least Auklets and Parakeet Auklets in the northwestern Bering Sea and Bering Strait, as contrasted with the relative abundance of the two species of Murres and the two species of Puffins in Kotzebue and Norton Sounds. These differences are presumably correlated with patterns of temperature, salinity, oxygen saturation and nutrients in the sea water, but to my knowledge such correlations exist only anecdotally. The Ashmoles (1967) reported on a similar study of the ecology of tropical seabirds.

Biologists have recorded large daily and annual changes in the numbers of seabirds at nesting colonies and in many cases large "die-offs" have been reported. We have recorded important differences in the population stability and reproductive success among Herring Gull colonies in New England, even when the colonies are close to each other. In order to appreciate the dynamics of seabird biology and to have baseline data by which to assess the impact of environmental insult resulting from resource development, one must know the normal limits of varieties both from year to year within colonies and between colonies.

4. To meet this task will require access to data available from studies of other scientists in this area such as (A-5) those making photographic surveys of seabird colonies,

A-8 and A-9, A-14 and A-15, those determining the distribution and abundance of pelagic and demersal fish and their food dependencies,

A-23, those determining the seasonal density, distribution and requirements of principal species of plankton,

B-2 and B-4, those determining circulation patterns, characteristics of water masses and effects of restricted circulation such as occur in Norton Sound and coastal lagoons.

5. Data on species and numbers in sampling areas; measurements of breeding success at study sites; and preliminary identifications of samples of food will be available after the end of each field season 1975. Because the field season of 1976 will end in late September, only preliminary results can be available by 30 September 1976. The comparative and synthetic work requiring access to field data collected by others must be undertaken after the field season has finished.

6. Related research.

V. B. Methods.

1) Available printed information:

A bibliography of published materials on the seabirds of Alaska has been prepared under Dr. J. Bartonek's direction and we have collected a card file of Bibliography on seabirds during the last 15 years. These publications will be reviewed for relevant material. We will have to depend upon others for advice on key papers on fisheries, plankton and ocean currents.

We have requested a bibliographic research for information on seabirds and prey species in the northern Bering Sea to be carried out by OASIS.

2) Sampling scheme:

a) At seabird colonies

i) To identify species and count numbers we will make sketch maps of the colony, identifying landmarks. We will set up identificable plots on which nests are counted and density measured. We will, as far as possible, make photographic records of the situation in the colony in 1975. When seabird colonies increase or decrease, they characteristically change their areal extent, while central or preferred sites remain unchanged.

ii) To define the schedule of breeding we will establish study plots and keep daily or weekly records at them.

iii) To measure reproductive success we will establish study plots, mark nests, identify contents and follow the marked nests through the season. For Murres we will probably have to use approximate methods such as photographs or counts taken at fixed places at regular intervals.

The times of major importance are at the peak of egg-laying and at the time when a maximum number of young are on the cliffs. The quality of results will depend upon developing special techniques in the field suitable for each species.

iv) To measure feeding rates we will post watches at cliffs and at study plots.

v) To get food samples will be difficult. It may be possible to catch birds in large dip nets as the Eskimos have done. It may be possible to extract samples from nestlings or to collect food dropped at the foot of cliffs, as Tuck and Nettleship have done. It may be necessary to shoot some birds as apparently Swartz did at Cape Thompson and Bédard did at St. Lawrence Island. It will, however, be important to avoid disturbing the colony.

vi) To establish the local feeding areas, we will make short transects around the colony in an outboard motor boat. Experience of others indicates that 75% of birds feed within 10 miles of the colony. This generalization probably does not apply to Tufted Puffins. Carrying out this aspect of the project will depend upon sea conditions. A full assessment of the extent and use of the feeding grounds will require work to be done many miles from the colony in a seagoing vessel.

vii) Our previous work on colonial seabirds has used standard tests for statistical significance. Field data gathering has been planned to ensure adequate sample size. Our experience indicates that some bias is inescapable in sampling breeding and feeding areas because the items of interest are not distributed homogeneously, either at colonies or in feeding areas. We have the cooperation of an experienced statistician.

3) Criteria for inclusion and exclusion of certain species.

We will census the seabird species which nest in the study area (Pelagic Cormorant, Black-legged Kittiwake, Glaucous Gull, Common and Thick-billed Murre, Pigeon Guillemot, Horned and Tufted Puffin, Least Auklet, Crested Auklet, and Parakeet Auklet). We will record the species numbers and distribution of waterfowl (including shorebirds) observed in the coastal areas.

We will concentrate our attention on those fish and crustacea which make up large percentages of the birds' diet (Myxocephalus, Boreogadus, Ammodytes, and Mallotus), (Thysannoessa, Calanus, Eucalanus, Parathemisto, and Mycidacea, Gammaridae). Characteristically a few species of fish or crustacea make up 65% to 90% of a seabird's diet. In most diet samples the remaining species occur in very small numbers.

4) Methods of analysis

In measuring breeding success, we will compare numbers of pairs establishing territories to numbers of eggs laid, to numbers of young reaching an arbirtray age (Paynter 1947, Kadlec & Drury 1968, Nisbet & Drury 1972, Swartz 1969).

In comparing the distribution of seabird numbers with the density of foods we will use simple regressions. We do not expect that complex analysis will be necessary.

VI. Information products

A. Report on waterfowl observed in coastal lagoons and shallow inshore waters. This is planned as A) species list with remarks, and b) summary comments on the geographic regions which are found to be important.

B. Report on studies at nesting cliffs. This is planned as accounts of what has been learned about each species as to its numbers, distribution on the cliffs, schedule of breeding, reporductive success and feeding. A decision as to which species will get greater emphasis than others will be made after consultation with others and after reconnaissance in the field to see which species are suitable.

We will learn species composition and identify the schedule of reproduction at the seabird colonies at Bluff and Sledge Island. We will gather data on the reporductive performance of seabirds at the two colonies. We will have a photographic record and counts as baseline data for comparison of future changes.

The first year's data will be assessed after the first field season and plans then made for gathering data during the following season.

C. Report which will attempt a synthesis of data available from studies made by others in Norton Sound of 1)ocean currents and their nutrients, 2) the large zooplankton, 3) the small fish relative to the distribution of seabird colonies in the northern Bering Sea and the species composition in them. This synthesis will be outlined, the data collected and the report written after the field work is completed. This report will be possible only if suitable data are successfully gathered by others.

In my experience with field work, it is advisable to have thought out a number of plans for gathering data that contribute to a central problem. Once in the field it is necessary to adjust plans as opportunties are afforded. Changes in the birds, weather and sea can be expected to prevent carrying out some plans and to offer unusually good changes to carry out others.

VII. Data interface

In order to prepare an overview of the factors influencing the distribution and numbers of seabirds, we will need summaries, interpretations and relevant data from studies on 1) ocean currents in the northern Bering Sea and Bering Strait, 2) the distribution and density of plankton relative to saline, brackish currents and eddies, 3) the distribution and concentrations of small fish.

Exchange interface

The data on waterfowl use of inshore waters and coastal lagoons will be used in fish and wildlife planning. Data on seabird biology will be used in assessing seabird colonies, plans for their management and in general systems models.

Data will be tabulated on forms suitable for coding on cards and these will be submitted to the project officer for key punching and transition onto magnetic tape.

We will require retrieval of our own data at later times as listings of behavior or population parameters displayed against environmental characteristics such as weather, distance, characteristics of water masses, zooplankton or pelagic fish.

Data will be delivered late in 1975. It will include tabular details on species numbers, density and geographic distribution in study areas. Schedule of funding, measurements of breeding saucers, counts made on transects identification of food, numbers of individuals banded by species. It is different to estimate before the first season how many punch cards of data will be produced.

VIII. Archival requirements

We will have a large number of photographs of bird cliffs which we use in our census. It may be that the Fish and Wildlife Service will want to keep these on file.

We will have a number of collections of food organisms. It may be that these samples should be centrally stored with other data gathered in the course of this project. However, I have a request from the Agassiz Museum at Harvard University, Cambridge, Mass., for specimens we collect.

IX. Schedule

1) Outline of plan for field season of 1975.

Work schedule includes the time periods: late May to 30 June 1975; 30 June to 30 September 1975; 6 weeks for processing field data in fall 1975; late May to 30 September 1976.

Survey of published information indicates that from mid-April until about 10 June, birds will be returning to and settling on the breeding colonies.

a) Seabird colonies. Between 10 June and 20 July seabirds will be mostly incubating. During this period study plots will be established, nest and egg counts made and most of the work done to establish a record of the species and numbers of the species at the two major study areas. Some transects should be made of the coastal waters to define feeding areas.

Between 20 July and 10 August eggs should be hatching, the greatest parental activity at the colonies should be in progress and the highest mortality rates of the chicks should be taking place. This period should be spent in studies at one colony site, observing and collecting food samples.

Between 10 and 20 August counts should be made of the numbers of chicks on the study plots to measure reproductive success. A second trip should be made to the alternate study site if possible. Transects of feeding areas should be made.

Between 10 August and 20 September fledglings should be leaving the colony and adults abandoning their feeding sites. A relatively wide search for concentrations of seabirds and waterfowl would be desirable during this period.

b) Waterfowl. If members of the party arrive in late May the migration period, that is until about 10 June, should be spent surveying the coastal areas -- shores, lakes and lagoons -- for migrants. During this time we should choose sites for later observations during the summer.

The southward migration of adult waterfowl should be beginning in early July. Immatures should gather in mid-August. It would be desirable to locate coastal gathering places during that period.

We expect that freeze-up of the sea may take place in the first week of October.

It will be important to have some members of the party in the field to record happenings at each stage of the migration and the breeding season.

Analysis of field observations of the waterfowl use of coastal areas will be completed during the fall and a report submitted.

Collating data on seabird numbers, analysis of measurement of breeding success and reports on observations of feeding behavior and food will be completed before 1 January 1976.

In the first quarterly report a schedule will be prepared which estimates data types, approximate types, and dates of submission.

I would expect to have preliminary discussions with oceanographers and fisheries biologists to review data gathered during the field season of 1975 and plan work for 1976. The synthesis of the relation of seabird colonies to the characteristics of ocean currents cannot be undertaken until the oceanographic data and interpretations are available.

2) Laboratory and library work.

This work will be planned in the early fall on the basis of field data available and discussions with seabird biologists at the international meetings at Seattle in May 1975.

About 6 weeks is planned for the processing of field data.

3) Field work for the 1976 season will be planned on the basis of the first year's experience and results. The Principal Investigator's previous commitments may require special arrangements to be made to fill needs for field work at the beginning and end of the season. Drury will be on the staff of the College of the Atlantic, Bar Harbor, Maine, 04609, beginning in March 1976. The administrators of the college have endorsed the continuation of the field work.

4) This proposal extends through the end of the field season in September 1976. Reports on field work will be prepared. It will, however, be necessary to obtain additional support for data processing and preparing the study of the geographic and trophic relations of the seabirds with the oceanography of the regions at the end of the field work in 1976.

B. Interfaces among elements of the study.

There are three parts to the colonial seabird studies: studies at Sledge Island, studies at Bluff, and studies on near-shore feeding grounds.

The observations of waterfowl on coastal waters and lagoons will be made between the periods spent at seabird colonies.

The synthetic study of the geographic and trophic patterns will have to be coordinated with oceanographic and fisheries studies. It will be important to have suitable observations on marine birds carried out on the ships making oceanographic or fisheries studies when those ships are within feeding range of the seabird colonies included in the wider scope of this study. These colonies include those on southern shore of the Seward Peninsula and the onshore small islands such as King Island, Sledge Island and Egg Island. The observers involved should be associated with the present study or briefed by us.

X. Equipment requirements

A small boat such as a 16-foot inflatable skiff with 25 horsepower outboard and spare outboard, life jackets, compass, anchor lines, etc., are needed for work in the near shore areas around the seabird colonies and to make short trips to feeding grounds in good weather.

Binocular and telescope for observations (personal equipment).

Climbing safety equipment for work around seabird cliffs.

As the study progresses it may emerge that special equipment will be desirable to sample the density and distribution of the larger zooplankton and small fish within the feeding areas of the seabird colonies being studied.

Two-way citizen's band radio.

Equipment to catch seabirds, and to preserve specimens of their food. This equipment will be needed throughout both field seasons.

XI. Logistic requirements

a) Travel to Nome and return for party members.
b) Storage space in Nome as base of operations.
c) Automobile transportation for access to lagoons in the Nome area.
d) Flying time 1) for transportation to seabird cliffs at Bluff and other sites if such travel becomes necessary; 2) for surveying seabird cliffs in inaccessible areas.
e) Transportation by boat (local fishing boat) to Sledge Island once or twice in each field season, and perhaps to King Island, Egg Island, Cape Darby, Cape Denibigh or the area near Cape Wales.

f) Lodging while at Nome when the party is transferring from one study site to another and while they are making waterfowl surveys.
g) Camp equipment and food supplies for two field seasons.

Personnel can supply their own field equipment including optical equipment and cameras. The rest must be supplied in the terms of the contract.

WORK STATEMENT

Research Unit 239

I. TITLE: Ecology and Behavior of Southern Hemisphere Shearwaters (Genus Puffinus) and other Seabirds, when over the Outer Continental Shelf of the Bering Sea and Gulf of Alaska during the Northern Summer

II. PRINCIPAL INVESTIGATORS:

* Contract with The University of Calgary

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It is intended that Mr. Juan Guzman will use the data collected for his graduate research thesis and that he will subsequently be able to publish it in concordance with the Policy and Procedures of The University of Calgary regarding contract research. This would follow submission of reports to the Alaska OCS Program Office in accordance with the contract.

III. GEOGRAPHIC AREAS AND INCLUSIVE DATES:

Bering Sea and Gulf of Alaska together.

Because the Slender-billed Shearwater occurs first north of the Aleutian Islands chain in early summer but moves south of it in the early fall, no distinction between the two regions has, as yet, been established in terms of biological significance. Data from the two regions can be reported separately, of course, but must be analyzed and discussed as a unit.

DATES (Approximate time allocations to Cruises)

FY1975	June 1975	12 days ashore	Bering Sea
		18 days at sea*	"
FY1976	July 1975	30 days at sea	Gulf of Alaska
	August 1975	23 days at sea	"
		7 days ashore	"
	May 1976	10 days ashore	Bering Sea
		20 days at sea	"
	June 1976	30 days at sea	"
	July 1976	30 days at sea	Gulf of Alaska
	August 1976	15 days at sea	"
		12 days ashore	"

Note: These projections can only be approximate and ideal until we are informed of ship schedules. Thus there may well be days ashore, instead of at sea, in those months marked as "30 days at sea."

IV. COST SUMMARY:

FY 1975	FY 1976	Total
$3,100	$8,900	$12,000

V. PROPOSED RESEARCH:

A. Background and Objectives

Tasks

Input data:	Primary Emphasis	Secondary Emphasis
		A-4
	A-5	
	A-6	
		C-2
		E-2

Output data from other concurrent studies that we will be asking for as related data necessary for the interpretation of the data collected by us.

* see page for ways in which this does/does not imply control of a ship and/or its launches.

Primary Emphasis	Secondary Emphasis
A-7	
A-8	
A-16	
A-23	
A-24	
	A-25a and A-25b
A-32	
A-33	
A-35	
B-1	
B-2	
B-4	
C-1	
C-3	
E-1	

Note: The reason that our requirements of data from other "tasks" is so long a list, as compared with listing of input data from our own study, is that seabirds are at higher trophic levels in the ecosystem. Interpretation of the seabird distributions and behavior are dependent on the distributions of these other organisms (food types) and chemical contaminants. Hence, our needs for "output data" from other studies are considerable, which should present few problems in view of the manner in which the collected data is to be archived.

* Present State of Knowledge

In summer the Slender-billed Shearwater (Puffinus tenuirostris) and the Sooty Shearwater (Puffinus griseus) are the most numerous species of seabirds over the Outer Continental Shelf of the Gulf of Alaska. Neither species breeds in Alaska, however. One of the unexplained facts about Sooty Shearwaters is that they 'vary in numbers from day to day in any given locality' (Martin & Myres, 1969).

The Slender-billed Shearwater is the "mutton bird" of Australian commerce. It makes a circuit of the North Pacific Ocean during its annual migration, perhaps to avoid unfavorable wind conditions during a return migration by the same route. It is the more common of the two species in the Bering Sea and among the Aleutian Islands. The Sooty Shearwater is the more common of the two species in the North Gulf Coast and in the waters of Southeastern Alaska. The OCS Draft Study Plan refers to

such seabird populations of the Gulf of Alaska as an 'international resource', and this the shearwaters from southern Chile, New Zealand and Australia certainly are. They visit United States waters during the austral winter (northern summer) from May to September.

Despite the writings of Murie (1959), Garielson & Lincoln (1959), Bartonek & Gibson (1972), Bartonek (1971, "102 Statement - description of bird resources along proposed tanker route from Port of Valdez to southern terminals)", Isleib & Kessel (1973) and Martin & Myres (1969), the ecology of shearwaters of the genus Puffinus is not well understood for the period of the year when they occur in the Bering Sea and the northeastnmost North Pacific Ocean. It will suffice to suggest that there must be good reasons for them coming there, and that interference with the food chain on the OCS would cause the extinction of these most abundant birds, since they evidently depend on the resources of the region for a large period of the year. The numbers of shearwaters observed at Ocean Weather Station "Papa" at 50 N., 145 W. in the center of the Gulf of Alaska is not spectacular, so it is evident that more information is required on the width of the coastal zone along which the shearwaters feed and migrate.

The only unpublished data known to us for the continental shelf is of observations by Terry Wahl (Washington), and Ian Robertson (for the Canadian Wildlife Service) and P. W. Martin (both off British Columbia). Unpublished Alaskan data is not known to us though much may exist.

* Information Required

Information is sought on Southern Hemisphere shearwaters while in Alaskan coastal waters (OCS) for the following reasons:

(1) the numbers of birds involved and their role in the ecosystem during the summer months when Northern Hemisphere seabirds are breeding along the coastlines,

(2) Their importance as members of the faunas of Australia, New Zealand and Chile.

One of the main objectives is to study the behavior and ecology of the shearwaters in the pelagic zone, particularly:

(1) what determines their day to day fluctuations in numbers in any locality, and

Both studies should be, as far as possible, related to regional meteorological, oceanographic and feeding conditions. These should be available from other groups in the Alaska OCS program.

We are particularly interested in:

(1) clarifying the respective distribution patterns of the Slender-billed and Sooty Shearwaters, and in determining the likely causes of these differences,

(2) obtaining information in depth on the individual and group behavior of the shearwaters and their flock dynamics, both internal and in relation to environmental factors, and

(3) obtaining specimens for analysis by others to establish baseline data on petroleum-derived and pesticide residues in the shearwaters that spend the summer months in Alaskan coastal waters as at the present time.

Petroleum Residues

Shearwaters travel along both the North American coast and the coast of Japan during their migrations across the equatorial, tropical and temperate latitudes. They are thus exposed to pollutants in a wide range of latitudes and regions, including DDT derivatives from atmospheric fallout and PCB's from industrial outfalls. In addition, one of the busiest oil tanker routes in the world is that from the Persian Gulf to Japan and Slender-billed Shearwaters migrate along this during one sector of their annual migration. They thus have plenty of opportunity for ingesting petroleum products. The degree to which these are harmful and in what manner is hardly known, aside from acute toxicity and loss of thermoregulatory capabilities.

Slow, chronic, harmful effects on seabirds from petroleum breakdown products and fractions may be important factors affecting reproductive capacity, life expectancy and carcinogenic pathology (Clark & Kennedy, n.d.; Hartung, 1965; Hartung & Hunt, 1966; Bingham et al. 1965; Crispins, 1961; M.R.C., 1968). Baseline data on petroleum-derived and pesticide residues in the tissues of Southern Hemisphere shearwaters when in their winter quarters in the northern hemisphere may halp to establish in which hemisphere and in which region of the Pacific Ocean they obtain the most part of these residues. Such data would be most valuable if obtained before any wells go on stream on the OCS of Alaska. It is essential to determine the extent to which Southern Hemisphere shearwaters already contain such residues obtained elsewhere than in United States waters when they arrive in the OCS areas each year.

Shearwater Flock Movements in Relation to Weather Systems

Bad weather occasionally causes mortality to seabirds on a large scale, but perhaps not as often as might be expected. Manikowski (1971) has established that some seabirds leave an oceanic region that is in the path of an advancing storm or advancing fronts associated with cyclonic conditions. Shearwaters quite probably make cyclone-related 'weather movements' from one locality to another although, because of their extreme evolutionary adaptations to a soaring ('water-shearing') flight along ocean swells, their movements may perhaps be such as to avoid regions where wind speeds are low or negligible (anticyclonic conditions). It is a primary objective to determine the reasons why shearwaters are 'here today and gone tomorrow,' and find out if winds, currents, upwellings, or changes in plankton or fish densities are the most important determing factors. Ideally, it should be possible to predict for a particular locality and week of the year the likelihood of shearwaters being present (or abundant or scarce), in the same manner that can now be applied in estimating the bird hazard to aircraft from the daily weather maps. In this way the risk of an oil spill at a particular site insofar as shearwaters are concerned might be determined.

Seabird Mortality and Residues-Indicated Stress

W. Nelson and M. T. Myres (unpublished MS) have suggested that the ratios of biocides in different tissues of the body of a bird may be indicative of the degree to which it is stressed by its environment at the time, whether this be by bad weather or a failure of the feed species or by oiling and subsequent thermoregulatory failure. The relative distribution of pollutant residues as between one tissue and another may change in shearwaters over quite short periods of a few days or a week or two in response to weather or feeding conditions. Seabird specimens taken under different conditions (e.g. different sectors of a weather system, or different current or upwelling conditions) could exhibit different values. Without testing this, the significance of 'baseline' residues levels from a restricted number of tissues only may be highly misleading.

Sanger (1972, P. 607) wrote that "the immediate problem is that very little is known about distribution, abundance, and movement of seabirds in the region and their relationships with the pelagic environment."

* Reports

Research would be completed by August 31, 1976, but it would not seem to be possible to have more than a brief interim

final report available by September 30, 1976. There is a limited number of laboratories where residues analyses of comparable quality can be carried out and we have not budgeted for the costs of such analyses. The time delays involved in getting results back are such that it would be impossible to report on them unless the U. S. Fish & Wildlife Service is prepared to assume the task and responsiblity and guarantee a date by which the samples would have been processed.

* Related Research

We hope for valuable input liaison to us from the following other OCS marine birds investigators, plus the "output data" sources mentioned in the section on "tasks", namely A-7, A-8, A-16, A-23, A-24, A-25a and A-25b, A-32, A-33, A-35, B-1, B-2, B-4, C-1, C-3, and E-1. We have not yet received lists of particular investigations under the PHYSICAL OCEANOGRAPHY, CHEMISTRY or BIOLOGY programs, but we hereby request copies of these lists, so that we can establish liaison with the investigators concerned (addresses will be needed as well as names and research program titles).

Dr. James Bartonek & Dr. Calvin Lensink:

"Literature Summary on Distribution, Abundance, Behavior and Food Dependencies of Marine Birds"
"Seasonal Distribution and Abundance of Pelagic Birds"
"Migration of Birds in Waters Subject to Influence by OCS Development"
"Feeding Ecology and Trophic Relationships in Alaskan Marine Birds"

Dr. John Weins:

"Community Structure, Distribution and Interrelationships of Marine Birds in the Gulf of Alaska"

B. Methods

* Archives, etc.

Very little unpublished information is available, and we do not plan to search for such data, except insofar as it is to be collected during the Alasaka OCS program contemporaneously with our own field data, as already indicated in this Work Statement in two places.

* Temporal and Spatial Sampling

This is entirely dependent on logistic information with which we have not yet been supplied. Our own preferences as to cruise dates and locations are already on Page 2 of this Work Statement (Section III). Birds cannot be sampled in the precise manner that, for example, water or micro-organisms can be. Methods of estimating numbers, etc., are discussed below.

* Species

Procellariiformes - Puffinus tenuirostris and P. griseus Oceanogroma sp.

Other seabirds, as time permits. When shearwaters and petrels are present these will be given complete priority since the attention of one observer cannot be concentrated on more than them if the fullest information is to be obtained on these primary objects of study.

* Analysis

Bailey & Bourne (1972) and Wahl (unpublished MS) have discussed the problems involved in couhting birds at sea, and have presented guidelines. Two methods of recording and coding data on seabird numbers recorded from ships have been developed by PIROP (Programme integre de recherches sur les oiseaux pelagiques) of Moncton, New Brunswick, Canada, and by King (1970, 1974) and his co-workers of the Smithsonian Institution's Pacific Ocean Biological Survey Program. The latter was a refinement of methods developed earlier by Nagahisa Kuroda (1960) of Japan. Coded information is recorded on log sheets for (1) bird sightings, (2) environmental conditions, and (3) sea log or cruise information. Sanger (1970) also used the indices of Kuroda, and more recently Sanger (1972, pages 596-597) devised an equation for the standing stock of "ecologically similar groups of species" by season and oceanographic domain. This was converted to biomass by inclusion of average weights of "representative birds". A new proposal is that of J. G. King et al. (1974). King et al. (1967) described methods for automatic data processing and computer analysis of stored observations. However, it is not the primary intent of our research to spend a major portion of the time at sea counting birds with great precision. Shearwaters occur in either uncountable tens of thousands, or in varying degrees of smaller magnitude. Consequently, estimates of numbers on a logarithmic scale may be adequate for our purposes, except when numbers of the two species are fairly comparable.

Time will be better spent for our purposes if it is devoted to sample counts of the numbers of birds moving in particular directions, whenever directional movements are taking place, using (i) hand counters, (ii) radar, (iii) movie camera filming, etc., and in making observations on behavior and collecting specimens.

When shearwaters are absent, petrels and other pelagic zone birds may be studied using modifications (appropriate to the conditions) of the systems mentioned above. It will be necessary for us to adopt methods of counting, recording and storing seabird numbers data to permit consistent data to be gathered by all observers in the Alaska OCS program and the necessary equivalence of value of observations made by all observers so that all can draw on the total accumulated data in the archives.

We thus expect to use Alaska OCS marine bird log sheets prepared by the U. S. Fish & Wildlife Service, plus additional recording sheets to be devised by Mr. Guzman for the purpose of recording information specific to our tasks and study of the flock dynamics of shearwaters. Hand counters, a tape recorder and photography will be additional means of recording the movement of the flocks and the behavior of the birds.

We must emphasize that none of the recording methods devised so far is suitable for all purposes or best at all times. Birds may be counted against time, against distance travelled, or against one computed in to the other when the speed of the vessel is constant and known. Too little attention may have been paid so far to the direction and speed of the wind, and the direction and speed of the current, and the set of the ocean swell in relation to the heading (or the track) of the vessel; these may be particularly significant in the case of shearwaters, which use the ocean surface to obtain dynamic lift and propulsion. Furthermore, stationary vessels present an entirely different set of parameters from moving vessels, with a reduced emphasis on vessel speed and a more obvious need to relate the behavior of the birds to winds and currents.

For our study, besides knowledge of the position of the vessel and its speed and the weather and oceanographic conditions (for which greater details are requested in Section VII), we shall be recording information as observations or specimens permit on (i) relative numbers, (ii) direction of movement, (iii) flocking behavior, (iv) individual behavior, (v) feeding behavior, (vi) foods taken, (vii) sex of specimens, (viii) development of the gonads, (ix) age and/or reproductive status, (x) weight, (xi) weight of fat deposits, (xii) plumage condition (wear, oiling, etc.), (xiii) molt (detailed descriptions and/or photographs of live birds when possible in

addition to specimens), (xiv) tissue samples collected for biocides analyses or petroleum residues analyses, (xv) standard measurements, and (xvi) blood samples for various purposes, including the possibility of comparison of residues in the blood with that in various tissues. Collection of parasites may also assist in establishing the significance of these in the lives of these pelagic birds and in identifying the importance of various sectors of the food taken by shearwaters in determining the parasite load.

It is now less certain than in our second draft proposal that shearwaters of the species P. tenuirostris and P. griseus can be caught at sea, marked and examined alive and then released for possible subsequent sighting, although with other species of the genus this would be possible at lower latitudes. However, it may still be possible to use this technique with the Fork-tailed Storm Petrel (Oceanodroma furcata).

VI. INFORMATION PRODUCTS

Many of the types of information that will be obtained are covered in the previous section V (PROPOSED RESEARCH) and will not be specifically repeated in detail again here. The main findings are expected to be the following:

(1) The Degree of Overlap in the Distribution of the Slender-billed and Sooty Shearwaters at Sea, particularly during the late summer. The distances from shore (and the depth of the underlying water mass) at which each species preferentially occurs in the North Gulf Coast and south of the Aleutian Islands chain will be determined. It may be that, having spent the summer feeding in the Bering Sea, the Slender-billed Shearwaters are migrating, rather than drifting, once they have moved south through the passes in the Aleutian Islands back into the North Pacific Ocean. Also are there changes in the weather systems, water conditions or foods available that are concurrent with the beginning of the southwards journey in both species?

(2) Measurements and Plumage - The Sooty Shearwater breeds both in Chile and in New Zealand. Measurements and descriptions of both living and taken specimens might find some differences between them that could be used to determine the country of origin of these two populations in the non-breeding season.

(3) Preferences for Particular Oceanic Conditions - A determination whether there may be differences in the food species of the two shearwaters when they occur in separate ocean areas (Bering Sea versus Gulf of Alaska) as compared with when they occur together in the Gulf in late summer.

(4) Molt and Reproductive States - The birds will be examined during the austral winter months, when it is presumed that they will be in a non-reproductive condition and various stages of molt. If this is still so as late as August and September, we will so report.

(5) Behavioral Dynamics of Seabird Flocks - This is a relatively unknown subject, and one that is of special interest at both the individual and group (social) level. The degree to which the birds are coordinated in their activities, and in what manner this is brought about, will be described.

Correlation of flight directions of moving mid-summer flocks with the pattern of passing weather systems (as pioneered by Manikowski) will be attempted.

The activities of shearwaters at night (e.g. feeding activities or movements) will be assessesd, if equipment available aboard ship makes this possible. Recently, Grubb(1972) has used the "Starlight" scope image intensifier to study the foraging of petrels and shearwaters at night. The ship's radars will be used to determine if movements of shearwaters can be tracked with them at night.

(6) Baseline Residues of Pollutants in Tissues - In addition to samples from shearwaters, the purposes and handling of which have already been discussed earlier, samples may also be taken from petrels (Genus Oceanodroma), since the two species occurring in the northeastern Pacific Ocean occupy different oceanographic regions when at sea, with possible consequence that one may be more heavily loaded with biocide and other residues than the other. As explained earlier, residues analyses will only be ready by September 30, 1976, if the analyses required can be arranted at no cost to this research unit. Though vitally important for the proper interpretation of environmental impacts of petroleum-derived residues on populations of shearwaters and petrels, these analyses may not be available in time for proper consideration. The importance of obtaining the samples as baselines, however, remains urgent, which is why we plan to do so.

(7) Data will be tabulated in a form suitable for transcription to IBM key-punch cards. The archival format will be decided in cooperation with the Alaska OCSEP Project Office. (We are not proposing to transcribe the data to magnetic tape ourselves).

VII. DATA OR SAMPLE EXCHANGE INTERFACES

Output data that we require for interpretation of the bird data we shall be collecting was already listed on Page 4 under Section V.

(a) Tasksand on Page 7 under Related Research. These symbols will not be repeated here. Instead, we list the precise information that we will be needing:

(1) Specimens of shearwaters and petrels collected by other personnel.

(2) Precise information on the position of the ship every hour.

(3) Daily Weather Charts for the area, plus wind direction and strength on an hourly basis at the ship. Wave heights (ocean swell) and the distance between the crests of the ocean waves (or swells) are required as they play a role in determining the flight strategy of shearwaters when on the move.

(4) Ocean Current data, particularly in respect of directions of currents, current boundaries and mixing, current convergence-lines, tide-lines and upwellings, as recorded by the ship and researchers.

(5) Temperature and Salinity data taken from the vessel.

(6) Information on rain fronts and rain precipitation, as recorded on the ship's radar.

(7) Immediate notification of movements of birds when recorded on ship's radars, particularly when they are taking place at night, and the opportunity for the active Principal Investigator to use the ship's radar to search for such movements at night.

(8) Brief summaries of the plankton and fish taken from the vessel in 12 or 24 hour plots.

(9) Distance of the ocean floor below the vessel and the depth of detectable plankton and fish concentrations, as recorded by ship's sonar at regular intervals.

(10) Hourly reports of atmospheric visibility.

(11) From as many other vessels as possible to get radio reports of shearwater concentrations as they are seen, with additional information upon request.

(12) From other ships in the OCS program, regular observations made and reported of the direction of shearwater movements when these are clearly to be seen, plus wind direction and strength as recorded from the same ship at the same time.

(13) Assistance in obtaining shearwaters and petrels from small boats away from the mother ship, and assistance in identification of stomach contents of shearwater specimens collected.

(14) Analyses, by an appropriate laboratory, of tissue samples for DDE, PCB and light oil fractions from shearwaters, petrels, and the fish and invertebrate foods that they have been feeding on.

VIII. -------

IX. SCHEDULE (See VII, above)

Because the behavior of shearwaters is so highly determined by the conditions of the atmosphere and the ocean, it is desirable that required data from instantaneous on-line recording of meteorological and/or oceanographic parameters of concern to us, e.g. wind and sea conditions (Section VII, above) be made available to the Active Principal Investigator at the time or within 24 hours.

Likewise, because shearwaters are at the end of the food chain, information on both the presence, and also the absence, of plankton and fish concentrations will be required as soon as it can be provided by mechanical print-outs or other investigators.

X. EQUIPMENT REQUIREMENTS

It would be valuable if shearwaters could be detected at night by either Available Light Amplification Telescope or Infra-red Telescope equipment or "Starlight" Scope Image Intensifier equipment. Hopefully, this can be borrwoed from a U. S. Agency in Alaska itself, given assistance from the Alaska OCS office in doing so.

Aerial Cameras for use for low level instantaneous recording of sea surface phenomena, including the presence of large flocks of shearwaters and other seabirds, from helicopters or aircraft would be most valuable. The costs of film for such cameras have not been budgeted for in this proposal, however.

XI. LOGISTIC REQUIREMENTS

Shearwaters usually feed in areas of concentration of plankton, fish and marine mammals, so we assume that the biological part of the Draft Study Plan will be taking into account the "search" needs of biologists, and that helicopters based on one or more ships may be available. They would be a most valuable tool in finding concentrations of seabirds offshore, for study and sampling.

(a) The Active Participant Principal Investigator (Mr. Juan Guzman) will take advantage of ship time made possible by other planned investigations initiated under this program. To the extent possible he will make observations and counts in areas visited by such vessels (See Section III, Page 2).

The University of Calgary is not in a position to provide logistic support of any kind.

When informed of the ship schedules can we indicate which cruises would be useful to us and which sectors of the Outer Continental Shelf of Alaska it would be most profitable to visit in any particular week or weeks.

For optimal results, we would want small boats launched from a mother ship as often as possible, but not less than one day in every six at sea (weather permitting), which would improve viewing and make possible the capture of specimens of seabirds.*

* Specimen preservation will require freezing facilities of 20 square feet of lab bench space and availability of water and a sink.

(b) Mr. Guzman will attempt to obtain information on the distribution of shearwaters over a wider area than observations from ships and small boats would otherwise allow. If helicopter or aircraft surveys will be possible from either ship or shore facilities, his opportunity to encounter large flocks of shearwaters will be greatly enhanced.

WORK STATEMENT (Research Unit #330/196)

I. TITLE: The distribution, abundance and feeding ecology of birds associated with the Bering Sea and Beaufort Sea pack ice.

II. PRINCIPAL INVESTIGATOR:

George J. Divoky
U.S. Fish & Wildlife Service
Northern Prairie Wildlife Research Ctr.
Fairbanks Field Station
1412 Airport Way
Fairbanks, AK 99701

III. GEOGRAPHIC AREA AND INCLUSIVE DATES:

Bering Sea and Beaufort Sea
10 May 1975 through 30 September 1976

IV. COST SUMMARY:

FY 1975 through 30 June 1975	FY 1976 1 July 1975 - 30 September 1976
$8,800	$32,400

V. PROPOSED RESEARCH:

A. Background and Objectives

The proposed research addresses in part the following tasks identified in the Draft Study Plan "Environmental Assessment of the Gulf of Alaska, Southeastern Bering Sea and Beaufort Seas":

A-4 - Summarize and evaluate existing literature and unpublished data on the distribution, abundance, behavior, and food dependencies of marine birds.

A-5 - Determine the seasonal density distribution, critical habitats, migratory routes, and breeding locales for principal marine species in the study areas. Identify critical species particularly in regard to possible effects of oil and gas development.

A-6 - Determine the dynamics and trophic relationships of selected species at offshore and coastal study sites.

A-31 - Determine the relationship of living resources to the ice environment (including the edge of the drifting ice, land fast ice and inner pack ice) on a seasonal basis in the Bering, Chukchi and Beaufort Seas.

B. State of Knowledge

Information on the distribution and abundance of birds associated with the Bering Sea pack ice is limited to the data gathered by the principal investigator on a one month cruise and the incidental observations by Irving et al (Condor 72:110-112, 1970). A small number of unpublished reports are also available. Land-based observations have also been conducted but systematic observations are lacking. While the ice edge in the Bering Sea has been shown to be an important feeding area for seabirds, nothing is known about what the birds are feeding on.

A cruise by Frame (Auk 90:552-563, 1973) and two cruises by George Watson and the principal investigator (p. 681-695 in The coast and shelf of the Beaufort Sea. J. C. Reed and J. E. Sater (eds.) Arctic Institute of North America, 1974) have provided basic information on distribution and numbers at sea. These cruises have all been in rather open water outside of the 10 fathom contour. Little is known about bird-ice relationships in onshore areas or distribution and abundance during the seasons when icebreakers cannot operate in the Beaufort. Observations have shown Arctic Cod to be an important food item in the Beaufort Sea ice but little else is known about trophic relationships.

VI. INFORMATION REQUIRED:

Information is needed on the seasonal densities, species composition, and activities of species found south of the pack ice, at the ice front and in the various regions of the pack ice. The feeding habits of birds in all these areas also needs to be investigated. Data on both of these aspects needs to be gathered throughout the year.

VII. EXTENT TO WHICH REQUIREMENTS CAN BE MET:

The extent to which this data can be obtained is dependent on the amount of ship time available. Sixty days are required in each of the seas to begin to understand bird-ice relationships. Land-based work is meant only to supplement the pelagic work. If ship time is limited, the amount of information that is obtained will be greatly limited. Additional aircraft time will be needed if ship time is limited.

VIII. RELATED RESEARCH:

Related research is being conducted by Vera Alexander, who is studying ice edge productivity, and Ted Cooney, who is studying secondary productivity. Extensive use will be made of their data. Daniel Timm of the Alaska Department of Fish and Game will be studying the birds of the barrier islands of the Beaufort Sea and extensive cooperation, both in exchange of information and in logistics, is expected. William Drury is studying the birds of an ice afflicted coast and some cooperation with his project may be possible. Whenever possible, eggs will be collected and sent to the Patuxent Wildlife Research Center of USFWS for

pollutant analysis. Cal Lensink of USFWS is conducting a number of programs that can be of use to this project.

IX. METHODS:

Previous data - all previous information, both published and unpublished, will be analyzed and put on tape.

Sampling scheme - the sampling scheme will depend completely on the ship time available. If little at-sea time can be obtained, land-based observations will be the basis for the work. The following summarizes the basic method of sampling:

1. Observations will be made from a vessel operating in and next to the ice for at least three weeks in each of the following periods with ship-board observations being supplemented by aerial and land-based observations:

   Bering Sea
   - Ice formation (November-January)
   - Maximum ice coverage (February-March)
   - Breakup (April-June)

   Beaufort Sea
   - Ice formation (September)

   Ideally, most observations will be made on transects that run perpendicular to the ice edge so that stratification within and away from the pack ice can be ascertained. Open water south of the pack will have to be surveyed in order to see how far the influence of the ice extends. Vessel observations will be complemented by aerial surveys. In addition to allowing comparisons with data gathered from a boat, aerial surveys will allow data to be obtained in areas where ships cannot operate. Land-based observations and collecting will be conducted to provide information from areas where boats cannot operate. Information gathered during the course of observations will include but not be limited to location, species, numbers, behavior, age, class and molt.

2. Feeding behavior will be recorded in the course of all observations from the vessel. In addition, stations will be occupied at sea to provide more detailed information such as feeding methods, feeding rates, times of dives, and success rates. Birds will be collected for stomach contents analysis. Most collecting and detailed feeding observations will be done in areas where oceanographic sampling, including plankton tows and bottom grabs, is being conducted so that feeding data can be correlated with prey abundance. Oceanographic sampling would hopefully be done by investigators involved in studies of the plankton and benthos. If this is not possible vertical plankton tows will be conducted as part of this project.

Laboratory Techniques:

1. All observations of birds will be put on computer cards as will environmental and oceanographic data that might influence bird distribution. Satellite imagery will be used to supplement ice formation gathered during the course of bird observations. Bird distribution and abundance will be analyzed with regard to these oceanographic and environmental variables.

2. Stomach contents will be identified to the lowest taxonomic level possible. Volume of each prey group in the stomachs will be determined. Age, class, and size of prey organisms will be recorded.

3. Physical characterisitcs of birds collected will be recorded. These will include but not be limited to weight, fat condition, molt.

4. Specimens can be given to investigators studying pathology and pollutants.

Species to be studied:

Species to be studied will include any bird found just south of or in the pack ice. Thus, almost any species could be encountered but the following will be of primary importance:

Red Phalarope
Black-legged kittiwake
Glaucous Gull
Glaucous-winged Gull
Ivory Gull
Ross Gull
Thick-billed Murre
Common Murre
Black Guillemot

Method of Analysis:

Bird distribution and abundance and food items will be correlated with ice cover, sea surface temperature, weather condiditons and a number of biotic and abiotic oceanographic parameters. The data bank being developed as part of the OCSEP program will be utilized.

X. INFORMATION PRODUCTS:

All data gathered by the project will be coded and put on computer tape. This will be given to the OCSEP. Interpretation of the data will be contained in contract reports and publications resulting from the program.

XI. DATA OR SAMPLE EXCHANGE INTERFACES:

Information will be needed on sea surface temperatures, sea state, nutrient levels, primary productivity, secondary productivity, fish distribution and abundance, ice cover and decomposition. Information gathered by this project will be used by Cal Lensink and James Bartonek of USFWS.

XII. SAMPLE ARCHIVAL REQUIREMENTS:

No archiving is required. All bird and prey collected will be deposited with appropriate museums.

XIII. SCHEDULE:

Data will be gathered at the Bering Sea ice edge between 16 May and 1 June 1975. The only other cruise known at this time is a three week cruise in the Beaufort Sea in August 1975 (dates unknown). If these are to be the only cruises in and near the ice then the remaining work will be done from land. This will include work done at the following sites:

Gambell - June and December
Wales - June and December
Barrow - throughout the year
Kaktovik - throughout the year

Time spent at these sites will vary but will ususally consist of one to two weeks. Barrow and Kaktovik will be visited a least four times throughout the year. Data will be analyzed throughout the funding period. Unanalyzed data will be available shortly after the end of each field expedition. Analyzed data will be available by the end of 1976.

XIV. EQUIPMENT REQUIREMENTS:

Aside from the equipment that is included in the budget, a small boat out of Barrow and Kaktovik will be required.

XV. LOGISITICS REQUIREMENTS:

Vessel operations:

large

DISCOVERER - 15 May - 1 June 1975
GLACIER - August 1975

other cruises will hopefully be added.

charter boat from Gambell and/or Wales - June 1975 & 1976
December 1975

NARL boat from Barrow - dates uncertain due to ice variability

charter boat from Kaktovik - dates uncertain due to ice variability

Aerial logistics:

Much of the aerial work will be done on a space available basis with Dan Timm's survey of the barrier islands in the Beaufort Sea and with marine mammal surveys being conducted by NMFS.

Lodging:

Lodging at Gambell and Wales will be arranged with locals or a campsite will be established. Lodging at Barrow will be at NARL. DEW-line sites along the Beaufort Sea will also be used.

WORK STATEMENT (Research Unit #337)

I. TITLE

Seasonal Distribution and Abundance of Marine Birds

II. CO-PRINCIPAL INVESTIGATOR

Calvin J. Lensink
and
James Bartonek

III. GEOGRAPHIC AREA

Gulf of Alaska	May 1975 thru September 1976*
Bering Sea	May 1975 thru September 1976
Beaufort Sea	May 1975 thru September 1976

*Termination dates indicated are end of present funding period. However, the study is designed to be continued indefinitely beyond this period in all OCS areas.

IV. COST SUMMARY

	FY 1975	FY 1976
Salaries	$ 4,000	$64,000
Benefits	1,000	25,000
Equipment	6,000	3,000
Travel	500	5,000
Expendable Supplies & Services	500	7,000
TOTAL	$12,000	$104,000
Logistics costs not including ship support	$20,000	$235,000

V. PROPOSED RESEARCH

Background

This proposal addresses those portions of Study Plan Task A5 that consider seasonal density distribution of marine birds, and the identification of critical species and areas in regard to possible effects of oil and gas development. This proposal considers only the pelagic environment and does not include species generally confined to littoral habitats nor does it directly consider the distribution of pelagic species when these occupy shoreline habitats as during the breeding season.

The project covers all OCS areas as assignment of personnel, equipment, and necessary coordination of studies requires that all three areas be considered concurrently to obtain maximum efficiency of operations. However, logistical cost, the major budgetary item, is considered separately for each area and the total for other costs is prorated as appropriate to each area.

Prior studies of similar nature are limited to those reported by King (1972) who, with a number of volunteer observers conducted censuses from Coast Guard vessels cruising in the Bering Sea in 1971 and 1972, and Montgomery (1972) who reported on aerial surveys in the same region. Information obtained from these preliminary surveys was utilized in designing the present study.

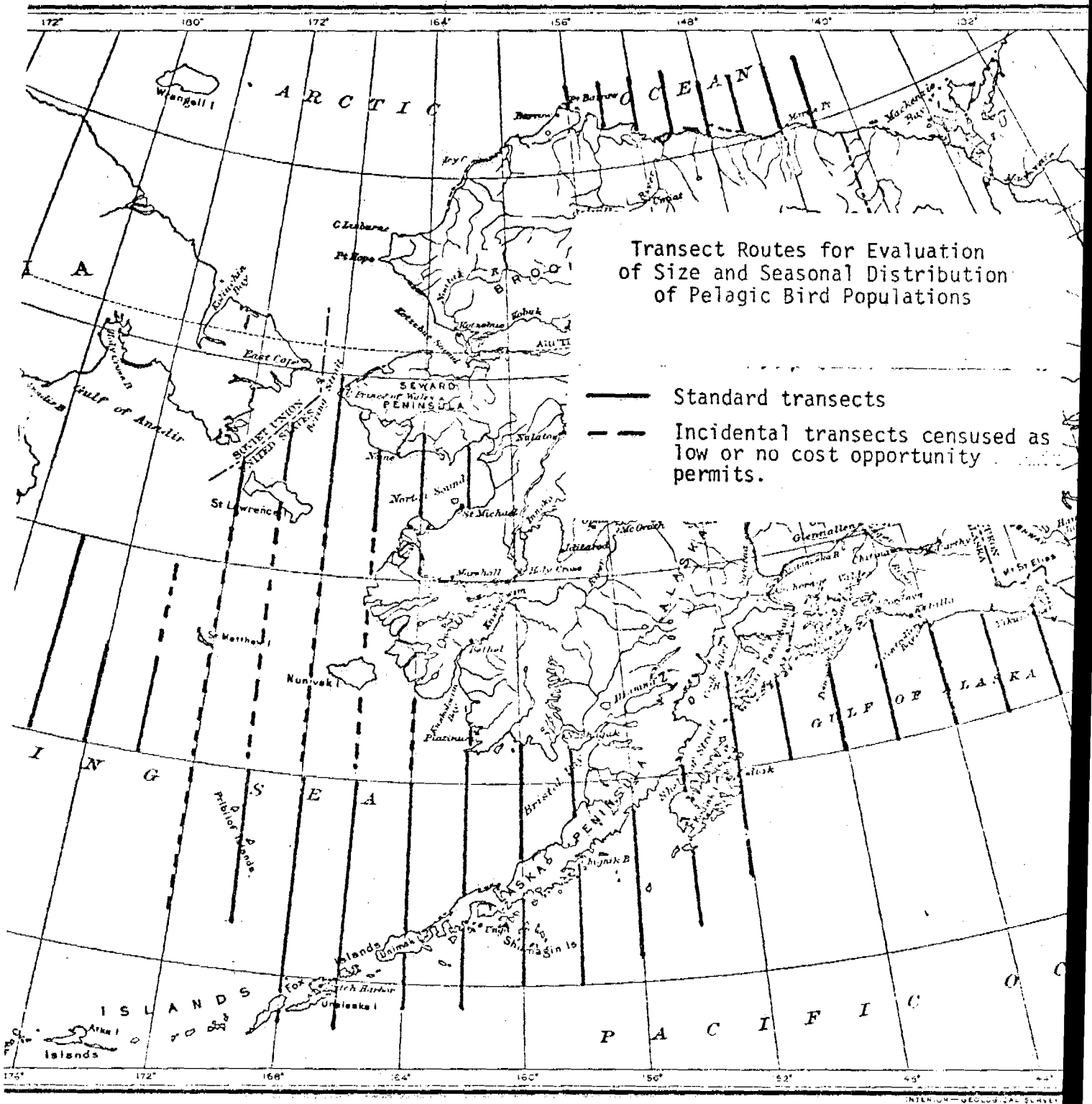
Methods

Data acquisition will rely on two general procedures: (1) extensive aerial surveys conducted systematically during all periods when significant changes in density or distribution are anticipated, and (2) censuses from shipboard which are considered necessary to directly supplement and compliment data from aerial surveys in order to provide ground truth data for analysis of aerial surveys, to permit improved identification of species, and to provide information on the relationship of density and distribution to food resources and other biological and physical parameters of the marine environment.

Aerial Surveys

Standardized aerial survey procedures will be utilized. Sampling will be conducted in all OCS regions on north-south transects following even numbered meridians, i.e. 152°, 154° ... etc. In addition, supplementary transects on odd numbered meridians or meridians ± 30 minutes will be censused in critical areas or when such transects do not appreciably increase survey cost, as when located on routes aircraft must utilize when returning to base. The location of all transects are identified on the attached map.

Aircraft utilized will be a P2V equipped with a GNS 500 navigation system capable of locating transects or transect segments within a tenth of an arc minute. All observations will be recorded by transect segment encompassing 5 or 10 minutes of latitude (5 to 10 nautical miles), or smaller segments as necessary. Supplementary data to be recorded for each segment include weather and sea conditions, distance from land, distance from nearest nesting colony, presence of fishing vessels or gear, type of vessel or gear, type of fishery, ice conditions, inciedent observations of marine mammals, and any other incidental information considered to be relevant to interpretation of censuses.



FOR SALE BY U. S. GEOLOGICAL SURVEY, FEDERAL CENTER, DENVER, COLORADO OR WASHINGTON 25, D. C.

Ship Surveys

Shipboard surveys will be conducted by observers placed on all ships as opportunity and/or as availability of qualified personnel permits. Observers will not require substantial equipment nor specific course or location assignments, thus their activities may be coordinated with virtually all OCS shipboard programs.

Data collection will parallel that obtained from aircraft, but will include the collection of preliminary biological and physiological information obtained from other OCS programs as available. Data from shipboard surveys will be site specific or summarized by 10-minute blocks of latitude and longitude.

Further responsibilities of shipboard observers will include the collection of materials and specimens essential for analysis of trophic relationships (Task A6 and A33) and toxicological studies considered in more comprehensive proposals.

Analysis of data will include a summary of seasonal density and distribution patterns in relationship to other biological and physical parameters as well as to the potential distribution of effects from oil and gas development programs.

VI. INFORMATION PRODUCTS

Unadjusted and adjusted estimates of populations of pelagic birds/ km^2 within each 10-minute block of latitude and longitude in which censuses are conducted. Data available in tabular form or on tape.

Synthesis reports for each aircraft survey period or ship voyage relating distribution.

Completion report describing seasonal distribution and abundance for all OCS areas and for all species in relation to location of shore colonies, distance from shore, food resources, and various oceanographic factors including depth, ocean currents, etc., and predictions of the probable effects of mineral development considering the above elements and the vulnerability of individual species.

VII. DATA AND SAMPLE EXCHANGE INTERFACES

Information on distribution patterns of birds obtained in this study will be utilized in evaluation of trophic relationships (OBS Proposal No. 7). Additionally, during this study observers will collect specimen materials required for use in other studies.

Bird observers will record and report observations of marine mammals observed during censuses; this information as well as incidental observations will be for use in appropriate studies of marine mammals.

VIII. SAMPLE ARCHIVAL REQUIREMENTS

Samples collected during this study will be submitted directly to principal investigators of other studies or appropriate laboratories.

Storage of all transect and station data on magnetic tape. Estimated volume is 10,000 transect or station records.

IX. SCHEDULE

Aerial surveys will be conducted seasonally as described under Logistics. Summary reports will be completed following each survey.

Census from shipboard will be conducted as opportunity permits with the anticipation that surveys will be conducted in all ocean areas during all seasons or when waters are open for navigation. Summary reports will be completed following each voyage.

X. LOGISTIC REQUIREMENTS

Aircraft

All air surveys will require use of a P2V aircraft presently operated by the Department of Interior, Office of Aircraft Services, Anchorage, or Grumman 780, specially modified for use in air surveys.

Estimated flight time and cost for each of the OCS areas considered is summarized below:

	No. of Censuses	Flight Hours	Cost FY 75	Cost FY 76
Gulf of Alaska				
Northeast	6	100	0	$50,000
Alaska Peninsula	5	110	0	55,000
Bering Sea	6	240	20,000	100,000
Beaufort Sea	5	75	7,500	30,000
		525	27,500	$235,000

An approximate schedule of censuses (i.e. of aircraft requirements) is provided in Table 1.

Ships

Requirements for ship transportation include reservation of space for two observers on all vessels capable of providing this service. Where space is limited numbers of observers may be reduced to one person.

On those vessels from which smaller boats may be operated efficiently, their use is requested as opportunity is available for the purpose of collecting specimens at sea.

TABLE 1

Provisional Schedule for Aerial Surveys of
Marine Birds:
Flight Hours Required by Area and Month

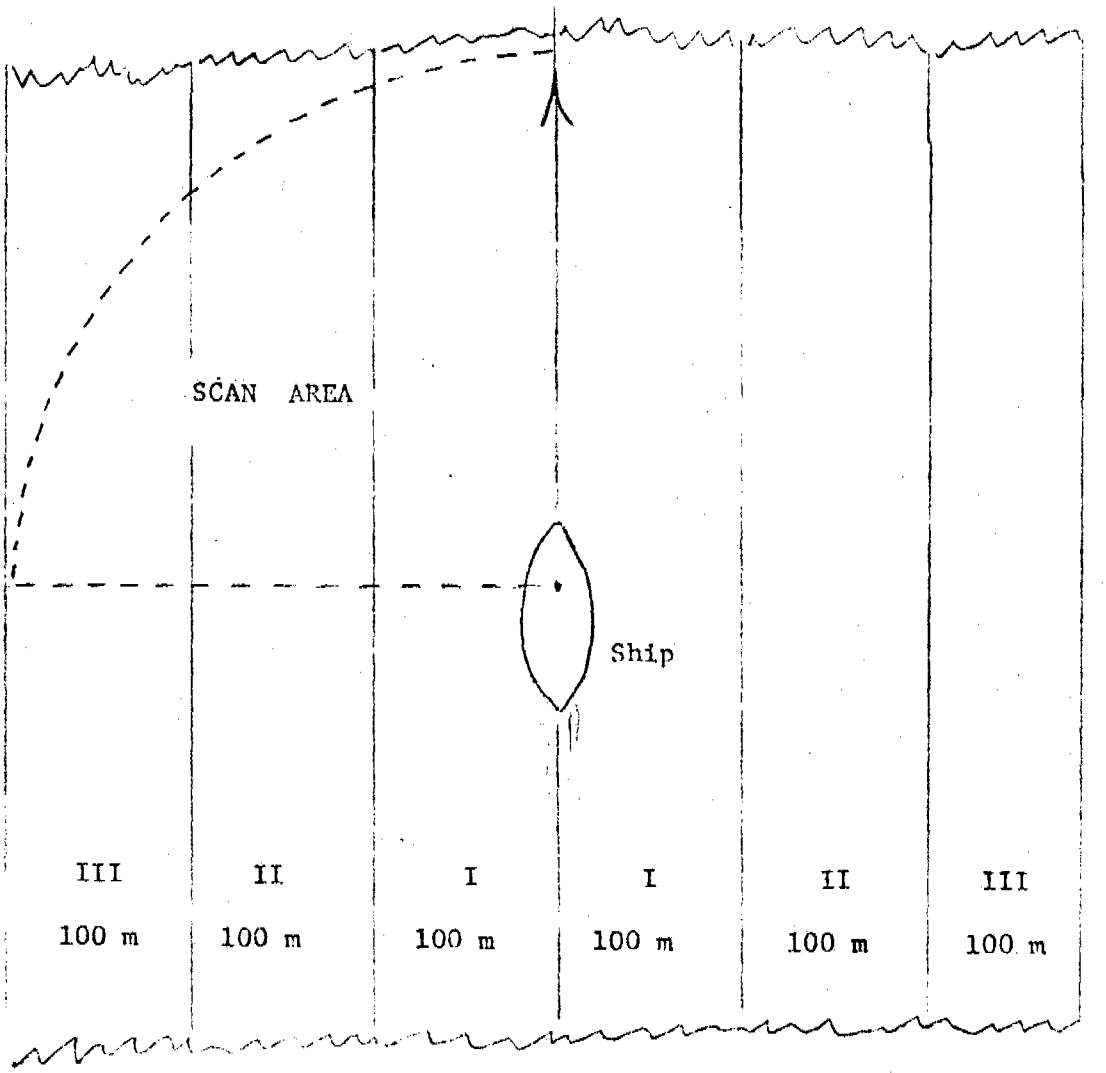
	FY 75				FY 76													
	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S
Gulf of Alaska																			
North East	a/	a/		a/			16		16				16			16			16
Peninsula							21		21				21			21			21
Bering Sea																			
Southern				25			25		25				25			25			25
Navarin Basin b/				6			6		6				6			6			6
Norton Sount				10			10						10			10			10
Central Bering Sea				c/			c/		c/				c/			c/			c/
Beaufort Sea				15		15							15			15		15	
Total				56		15	78		78				93			93		15	78

a/ Surveys accomplished under NEGOA program.

b/ May be deleted from surveys until leasing is imminent.

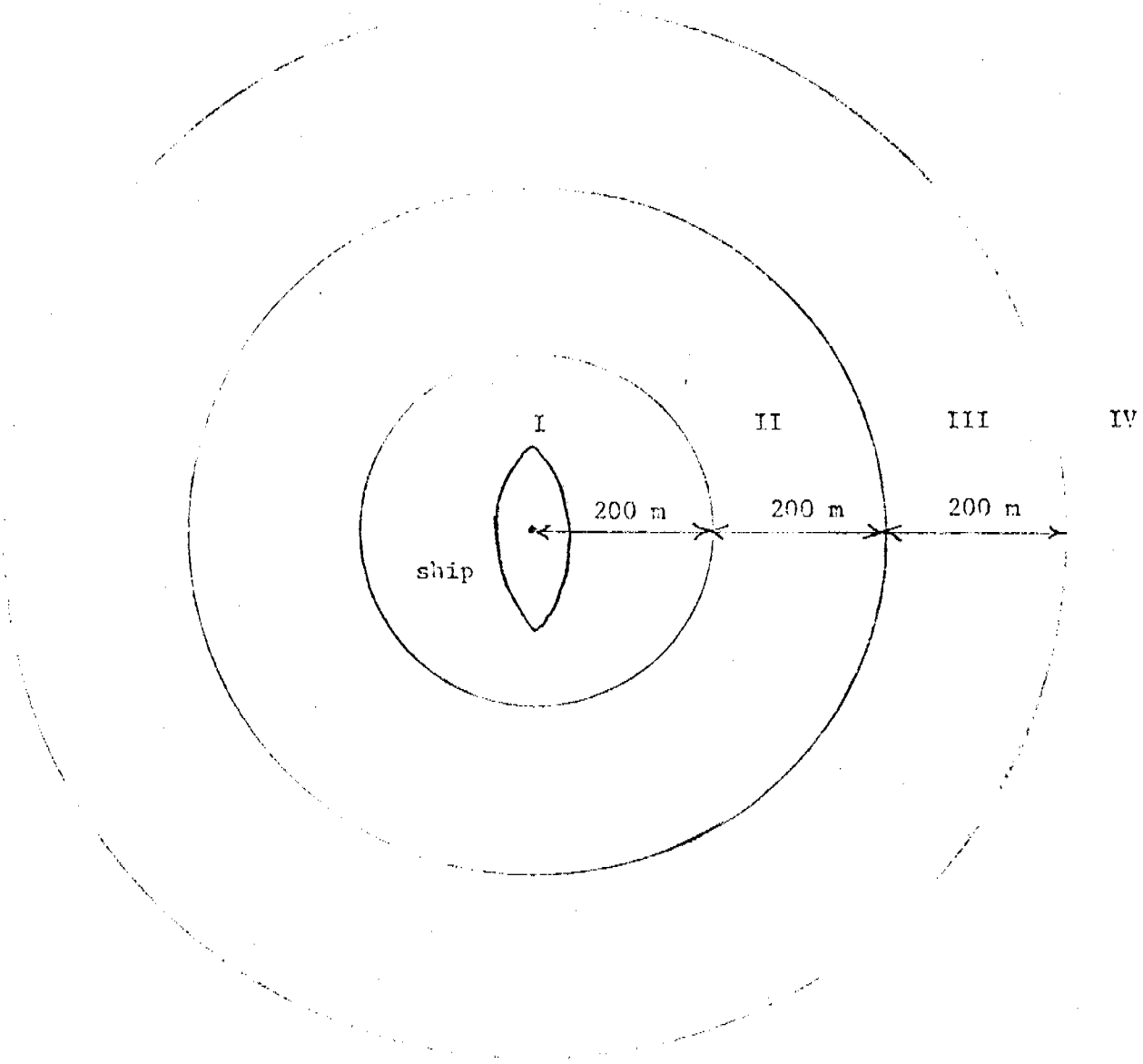
c/ Transects flown only in conjunction with other areas without substantial increase in flight requirements.

These requirements are identical for all OCS areas and all seasons. These requirements will be nullified or reduced in each case a specific project proposal (i.e., Divoky, Myres, or Wiens proposals) will serve to collect essentially identical information.



Scan area to 300 meters ahead and to the side of the ship with most favorable visibility conditions. Record data by Transect Strips which parallel the ship's course.

Conduct counts for approximately 15-minute periods. Area actually covered by sample will vary with the ship's speed. See instructions for Form OBS 2-57 for calculating area.



Count all birds within outer circle and record by zone. Areas sampled will total:

	Area (km^2)	
	In Zone	Cumulative Zone
I	.1258	.1258
II	.3769	.5027
III	.6282	1.1309
IV	≈	≈

For most species counts will decrease sharply in outer zones where visibility is impaired, but other species repelled by the ship may be counted most commonly in outer zone.

Form OBS 1-75

DISTRIBUTION OF BIRDS OBSERVED ON AERIAL SURVEYS
TRANSECT SUMMARY

This form is used to summarize data from aerial censuses. Standard transects normally summarized on this form will be flown in lines of longitude and the transect number is that of the meridian flown, e.g. 158° = #158, 158°30' = 158.3, etc. Standard transects will be flown in the P2V aircraft at an air speed of 120 k indicated air speed and an altitude of 150 feet. Use of nonstandard aircraft, flight speed, and altitude should be clearly identified in remarks.

Parts of the form are completed as described below:

Observer(s): Last name and initial of all observers.

Species: Insert species or group of species name and number which best identifies birds to which data applies, e.g. total all species 000000, alcids 3000000, common murre 300101. A list of species and their identification codes will be provided to all observers.

Date: Month/Day/Year

Time: Time at start of transect

Direction: Will always be north (N) or south (S).

Wind: Magnetic Direction/Velocity. This info is necessary for calculation of ground speed and is an indication of surface conditions.

Visibility: An index to overall conditions for censusing rather than visibility as reported for flight. The index is a subjective measure and considers factors such as sun glare, roughness of water, etc. Use a scale of 1-7 with one denoting poor and 7 optimum conditions.

Segment: Because all transects are flown on North-South meridians, all transect segments may be identified by latitude. Standard segments will start at each 10 minutes of latitude. Shorter segments may be used as necessary or desirable but do not exceed standard length or extend segments between even 10' intervals of latitude, e.g. 00'-10', 10'-20' etc., but not 05'-15' as segment will eventually be coded to densities/10' blocks of latitude and longitude. Transect segments must always be identified by their southern terminus. Shoreline terminus of transects should be identified to the nearest .1'. This figure can be obtained directly from the GNS 500 navigation system with which the P2V is equipped. If the northern terminus, this location should appear above the line on which the transect is identified and data recorded.

Number of Birds/Transect: In the heading space insert transect number and below insert total of birds observed in each segment. Because transects will not all terminate at the same latitude a 0 must be inserted for segments on which no birds were observed.

Total: Sum of all segments in transect.

Area (km^2): Total transect area. Standard segments 100 meters wide and 10 nautical miles long is equal 1.852 km^2. Area of nonstandard segments can be calculated.

Length in degree minutes (1 degree minute = 1 nautical mile)
X 1852
X width of transect in meters
÷ 1,000,000
= km^2

Birds/km^2: Divide as indicated. (This is not a very useful figure but see discussion below.

Remarks: Clearly identify nonstandard aircraft, procedure, or other information which may assist in evaluating transect data. Note unusual observation, condition, etc.

This form may be used for other analysis or data conversions. The most useful conversion is adjusting totals for each segment to birds/km^2. This permits direct comparison with data from shipboard surveys. Clearly indicate all instances such have been made or other case of nonstandard data.

DISTRIBUTION OF PELAGIC BIRDS OBSERVED ON AERIAL SURVEYS
TRANSECT SUMMARY

Observer(s) _____ Species _____

Date														
Time														
Direction														
Wind														
Ground Speed														
Visibility														
Segment	Number of Birds/Transect													
Total														
Area km^2														
Birds/km^2														

Remarks

Form OBS 2-75

PELAGIC BIRD OBSERVATIONS: TRANSECT RECORD

This form is used to record census data for marine birds obtained by systematic counts on transects while ships are underway. Transect locations are not pre-assigned and will be conducted from ships and locations of opportunity. Transect counts will normally be conducted during a period of 15 minutes. Thus, the length of transects will be determined by the ship's speed. Standard transects will cover a strip 300 meters wide adjacent to the ships bow, port or starboard, depending on which direction provides optimum visibility. This strip is divided into parallel segments 100 yards wide in which all birds and marine mammals are tallied. Division of the transect in this manner will permit evaluation of differences in visibility biases inherent with counting of the many species which may be encountered.

This form may also be used to record data using other censusing procedures, e.g., using a census strip directly ahead and on both sides of the ship. If such variations are used clearly identify the non-standard procedures in remarks and place an E in front of the transect number.

Parts of the form are to be completed as described below:

Region: The OCS Region of interest, e.g., Northeast Gulf of Alaska, NEGOA: Gulf of Alaska, GOA; Southern Bering Sea, SBS; etc.

Location: Latitude/Longitude to nearest minute.

Date: Month/Day/Year

Time: Time of start and stop of transect. Be exact as this interval will be used in conjunction with the ship's speed to calculate the length of the transect and the total area sampled.

Observers: Last name of each observer.

Weather: Weather data may be obtained from the ship's log. Sky cover is recorded in 10ths. Visibility here refers to clarity of atmosphere and is recorded in miles.

Sea State: May be obtained from ship's log. Waves are indicated by height in feet and swell by height in feet/compass direction.

Transect No.: Number each transect consecutively throughout each voyage. Number non-standard transects separately and precede number with an E (for experimental).

Ship: Name of ship and voyage number.

Course and Speed: True course (i.e. corrected for magnetic variation) and ship's speed in knots.

Visibility Index: Overall impression of censusing based on all variables, e.g., sea state, water glare, etc., but excluding ship's speed. Use numerical score of 1-7 with 4 denoting average conditions.

Census Area: Calculate census area in km^2.

Time of census in minutes ÷ 60
X ship's speed in knots
X meters in nautical mile (e.g.)
X width of transect in meters (e.g. 100,200, or 300)
÷ 1,000,000
= km^2

Birds/km^2: Each species observed. Identify to most finite taxonomic level possible. Unidentified list to family or part of family if possible, e.g. small alcid, large gull, etc. Include observations of marine mammals on bottom third of page.

Identification Number: Assigned number for each group necessary for computer processing. A list will be provided.

Number Observed: List each observation as it occurs, estimating distance and placing observation in appropriate column. Birds observed at distances greater than the normal transect width 300 meters, may be included in remarks. Although estimates of distance may be crude, such estimates will provide a quantitative base for estimating the proportion of birds actually observed. The length of the ship and apparent size of birds will be your primary references to distance when at sea.

Remarks: Include additonal observations, comments on large concentrations in or out of census strip, and any other information of value in interpreting census quality or which may have importance in interpreting the distribution of birds or mammals, e.g., presence of fish, plankton, etc.

This form may be used for casual observations at any place or time provided that location and ship's speed are available to calculate the exact size of the census area. All observations will eventually be transferred to computer tape and coded to each 10' grid of latitude and longitude (e.g. a block 10 nautical miles north and south but varying in width from about 3.4 miles at 38°N in the Gulf of Alaska to only 2.0 miles at 71°N in the Beaufort Sea). Cumulative records will eventually provide precise seasonal estimates of numbers and distribution of birds over extensive ocean areas.

PELAGIC BIRD OBSERVATIONS: TRANSECT RECORD

Region ____________________
Location ____________________
Date ____________________
Time Start ________ Stop ____________
Observer(s) ____________________
____

Weather: Air Temp. ____ ______
Wind Direction ______ Speed ______
Sky Cover ______ Visibility ______
Barometric Press. ______ Trend ______
Sea State: Surface Temp. ______
Waves ______ Swell ______

Transect No. ______
Ship ______
Course/Speed ______
Visibility Index ______
Census Area (km^2) ______
Birds/km^2 ______

Species	Ident. No.	Number Observed by Transect Segment			Remarks
		0-100 m	100-200 m	200-300 m	

Form OBS 3-75

PELAGIC BIRD OBSERVATIONS: STATION RECORD

This form is identical in most parts to the Transect Record (Form OBS 2-75), differing only in the right column in the upper section where Station Number and Station Observation Number are substituted for Transect Number and the ship's course and speed.

Entries are identical to those of the Transect Record except as described below.

Station Number: On Oceanographic Cruises this number is normally pre-assigned and will designate a point at which a variety of biological or oceanographic data may be obtained. If preassigned numbers are not available number stations consecutively as in the case of the Transect Record.

Station Observation Number: Number replicate samples at a single station consecutively during any uninterrupted period the ship is on station.

Number of Birds Observed: For station censuses, the sample area consists of series of concentric rings surrounding the ship - 0-100 meters, 101-200 meters, 201-300 meters, and beyond 300 meters (in remarks).

List birds observed within each ring in the appropriate column. The first census period should be conducted as soon as possible after the ship stops. Other census should be conducted intermittently thereafter. Behavior of birds and number observed will vary with species, time ship has been on station, and activity aboard or around the ship.

Remarks: Note nontabular information on birds, relative amount of activity aboard the ship, or other information which may be of interest in interpreting observations.

OBS 3-75

PELAGIC BIRD OBSERVATIONS: STATION RECORD

Region ____________
Location ____________
Date ____________
Time Start ________ Stop ____________
Observer(s) ____________

Weather: Air Temp. ____________
Wind Direction ________ Speed ________
Sky Cover ________ Visibility ________
Barometric Press. ________ Trend ________
Sea State: Surface Temp. ____________
Waves ________ Swell ________

Ship ____________
Station No. ____________
Station Observation No. ________
Visibility Index ________
Census Area (km^2) ________
Birds/km^2 ________

Species	Ident. No.	Number Observed by Transect Segment			Remarks
		0-100 m	100-200 m	200-300 m	

Form OBS 4-75

Summary Transect or Station Census Data

This form is utilized to summarize station or transect data from shipboard surveys. Data on this form generally follows corresponding field forms and entries are self explanatory.

Station or transect numbers are inserted on the first line in consecutive order. Check box in heading to indicate "transect" or "station" record. Maintain separate number series for transects and stations.

For standard use, enter the total number of birds observed within the 300-meter transect strip or station radius in the appropriate column and after the appropriate species. Enter totals of the preceding columns in the last column except as described below.

Leave two blank columns after replicate censuses at a single station or replicate transects within a single 10' block of latitude and longitude when counts are obtained in the same day. This will permit summarization or combination of records and facilitate statistical analysis. Similarly leave two (or more) blank columns after any group of censuses in widely separated geographic areas.

The form may also be used for various analyses, e.g., to summarize data in each of the transect segments, or for entering counts as birds per km^2, or other special purpose. In all such cases, clearly identify the source of original data (transect number and date) as well as the particular conversion or change from standard usage.

Note that the species list permits recording data at various levels of identification -- i.e., by individual species but also loon unidentified, gulls unidentified, small alcid, etc. Use the most specific identification possible. Additional species may be listed in the three blank lines near the bottom of the form.

Insert total of all species and total per km^2 for each transect as indicated at the bottom of each column.

Both the original transect or station record and the summary will be maintained on file in Anchorage. In addition, all data will be recorded on tape for computer processing and will be available through NOAA.

SUMMARY OF TRANSECT OR STATION CENSUS DATA

Ship _____ Observers _____

Transect ☐ Station ☐ No										
Date										
Region										
Latitude										
Longitude										
Depth										
Distance Offshore										
Area Sampled (km^2)										
Species	**Number Observed**									
Loon (unid.)										
Arctic Loon										
Common Loon										
Red-th'd Loon										
Yellow-B'd Loon										
Fulmar										
Petrel (Unid.)										
Fork-tailed Petrel										
Leaches Petrel										
Cormorant (unid.)										
D'ble-crested Cormorant										
Pelagic Cormorant										
Red-faced Cormorant										
Gull (unid.)										
Glaucous Gull										
Gl'winged Gull										
Herring Gull										
Mew Gull										
Kittiwake										
Arctic Tern										
Black Guillemot										
Pigeon Guillemot										
Murre										
Unid. Small Alcid										
Marbled Murrelet										
Kittlitz's Murrelet										
Ancient Murrelet										
Rinocerous Auklet										
Parakeet Auklet										
Crested Auklet										
Least Auklet										
Cassin's Auklet										
Shearwater (unid.)										
Slender b'd Shearwater										
Sooty Shearwater										
Puffin (unid.)										
Horned Puffin										
Tufted Puffin										
Total										
Total/km^2										

WORK STATEMENT (Research Unit #338)

I. TITLE

Photographic Mapping of Seabird Colonies

II. CO-PRINCIPAL INVESTIGATORS

Calvin J. Lensink
and
James Bartonek

III. GEOGRAPHIC AREA AND INCLUSIVE DATES

Gulf of Alaska	June 1975 thru September 1976
Bering Sea	June 1975 thru September 1976

IV. COST SUMMARY

	FY 75	FY 76
Salaries and Benefits		9,300
Travel		1,000
Equipment	2,500	0
Supplies and Services		6,900
Logistics		4,000
	2,500	21,200

V. PROPOSED RESEARCH

This proposal addresses in part the identification of critical habitats outlined in Task A5 and provides support to studies of population dynamics outlined in Task A6 of the Draft Study Plan. This proposal would provide high quality aerial photography of seabird nesting colonies considered essential as an aid to mapping and accurate census of colonies and as an important aid in studies of population dynamics, ecology, and trophic relationships. Prior use of photography by the Canadian Wildlife Service (Nettleship, D.N. 1972. Seabird Census Technique. Studies of Northern Seabirds, Report No. 4, Canadian Wildlife Service, Ottawa.) indicated that use of photography may be extended to actual census of some species and

although not the primary objective of this proposal, this potential will be fully examined. If satisfactory for Alaskan species and conditions, photographic censusing of selected study plots would provide a rapid and inexpensive means for monitoring the status of populations over broad geographic areas with precision not otherwise possible.

Cameras utilized will include a motorized Hasselblad suitable for horizontal photography of cliff areas, and an aerial camera suitable for vertical coverage as required ground nesting species (principally gulls) and for a few colonies of murres found in some island habitats.

Photo missions will be conducted during the nesting season, the period of maximum utilization of cliff habitat. These missions will be coordinated with other (census) missions to reduce project costs. Supplementary missions will include one extended survey mission in each of the CY's 1975 and 1976.

Area considered in order of priority include:

Gulf of Alaska (Barrier Islands, Middleton Island)

Bering Sea
- Pribilof Islands
- Bluff and Sledge Islands, Seward Peninsula
- Cape Newenham
- Unimak Island adjacent to Unimak Pass
- Little Diomede
- Shumagin Islands

Colonies at these sites are presently under study, or are proposed sites for long term studies as a part of OCS programs. Additional sites will be included where coverage can be obtained without substantial increase in logistical effort or cost.

VI. INFORMATION PRODUCTS

Anticipated product of the proposal include:

1. Availability of large format photography to principal investigator involved in site specific studies of trophic relationships and population dynamics (Task A6).
2. Photographic record depicting current status of colonial seabird habitats and potentiality of current populations.
3. Catalog of prints available and analysis report of habitat and populations covered.

VII. DATA OR SAMPLE EXCHANGE INTERFACES

Appropriate photographic coverage will be provided to all Principal Investigators conducting studies of colonial seabirds. Minor use of photo coverage is anticipated by investigators conducting projects in the littoral environment and on marine mammals.

Evaluation of photographs for use as a means of censusing seabirds will be coordinated with Fish and Wildlife Service study proposals NOS. OBS 4, 6, and 7 all requiring and supplementing information from these studies.

VIII. SAMPLE ARCHIVAL REQUIREMENTS

Data accumulated will be archived as a part of other projects.

IX. SCHEDULE

Photographic Missions: July - August 1975
June - August 1976

Reports: Quarterly and/or as required.
Final - December 31, 1976

X. EQUIPMENT REQUIREMENTS

Aerial camera presently property of Fish and Wildlife Service. No deployment scheduling required.

XI. LOGISTIC REQUIREMENTS

Ship Support: None required.

Aircraft: Safety and other requirements will require use of the P2V or Grumman N780 in all offshore areas (Pribilofs, Diomedes, etc.). Use of this aircraft will be coordinated with scheduled surveys eliminating all flight requirements other than those confined to specific sites.

Nearshore islands and mainland rookeries will be photographed from light aircraft currently assigned to the Fish and Wildlife Service.

Total flight time and cost:

Aircraft	Flight Time	Cost
P2V	5 hrs.	$2,500
Beaver or other a/c	20 hrs.	$1,500
	25 hrs.	$4,000

I. TITLE

Review and Analysis of Literature and Unpublished Data on Marine Birds

II. PRINCIPAL INVESTIGATORS

Calvin J. Lensink
and
James Bartonek

III. GEOGRAPHIC AREA

Gulf of Alaska
Bering Sea
Chukchi Sea*
Beaufort Sea

* All OCS regions including Chukchi Sea will be included as this additional area contains bird and mammal populations ranging into adjacent OCS areas and references specifically related to the Chukchi Sea may be cataloged with insignificant additional cost.

IV. COST SUMMARY

	FY 75	FY 76
Salaries	0	22,550
Benefits	0	7,500
Travel	0	1,400
Equipment	0	150
Supplies & Services	0	11,700
Total		43,300

V. PROPOSED RESEARCH

This proposal addresses study plan task A4 in summarizing and evaluating existing literature and unpublished data on the distribution, abundance, behavior, and food dependencies of marine birds in the Gulf of Alaska, Chukchi, Bering and Beaufort Seas. For the purpose of this study, marine birds are defined to include all species that are dependent on the coastal or marine ecosystem for part or all of their life cycle. This proposal seeks to achieve the task for all four geographical areas since any search of the literature would identify references pertinent to more than one area. Although there are published references which do not pertain specifically to any of the four geographical areas, some are germane to understanding ecological requirements of target species of marine birds within those areas. The summary and evaluation of information would, however, be made on a geographical basis whenever possible or appropriate.

Identification of pertinent published information will be greatly facilitated by use of several source documents, including already existing bibliographies. Recent literature will be reviewed to update existing coverage. Libraries of the U.S. Fish and Wildlife Service (Fairbanks, Anchorage, Juneau, Bethel and Cold Bay), Alaska Department of Fish and Game (Juneau), University of Alaska (Fairbanks) and the Arctic Research Lab (Barrow) contain a majority of the published information. Personal communications and searches of archives, however, will be required to obtain much of the unpublished information. Non-Alaskan institutions have contributed to the ornithological information and much unpublished information may lie outside of the state.

Pertinent publications and other sources of information will be reviewed and summarized. Summaries of each reference will be made, as appropriate, by species or groups of birds, informational topic, season of year, and geographic location. An estimated 1000 titles will be indexed and summarized.

Pertinent literature in a foreign language will be translated in part or entirety depending upon its significance. Scientists from the USSR and Japan will be solicited for information and to cooperate with joint or companion studies.

A master numerical code will be established for all Alaskan specie and species groups suitable for all automatic data processing and retrieval systems.

VI. INFORMATION PRODUCTS

The bibliographic citation will be stored on magnetic tape for retrieval by automatic data processing procedures, with retrieval being possible according to geographic location, species or groups of birds, season of year, topic of information and location of information if its distribution is limited.

The published and unpublished information that is reviewed will be synthesized and summarized by region, season, topic, species and group as identified in Task A4. Information acquired by OCS-related and other recent studies will be incorporated. The products will be descriptions of the bird resources and their habitats which would suffice for use in Section II, Description of the Resource, in an environmental impact statement.

Master index of species identification code numbers.

VII. DATA OR SAMPLE EXCHANGE INTERFACES

This study will require all progress and completion reports prepared under the OCS program to evaluate each report for relevance to studies of marine birds and to incorporate relevant material in the synthesis described above.

Bibliographic searches will be made for the principal investigators of bird-related OCS studies and for resource managers. Summaries or copies of references identified in the bibliographic search will be provided to the users as appropriate.

An index of numeric codes for species will be provided for use by all investigators.

VIII. SAMPLE ARCHIVAL REQUIREMENTS

Storage of approximately 1000 bibliographic titles with summary of contents on magnetic tape.

IX. SCHEDULE

Initial bibliographic data, estimated to include 1000 titles, to be provided on tape by April 1, 1976.
Tape and index file (FWS library) to be continuously updated as additional material is available.

Synthesis report to be provided by September 30, 1976.

X. EQUIPMENT REQUIREMENTS

Specialized equipment not required.

XI. LOGISTIC REQUIREMENTS

None

WORK STATEMENT (Research Unit #340)

I. TITLE

Migration of Birds in Alaskan Coastal and Marine Habitats Subject to Influence by OCS Development

II. CO-PRINCIPAL INVESTIGATORS

Calvin J. Lensink
and
James Bartonek

III. GEOGRAPHIC AREA AND INCLUSIVE DATES

Gulf of Alaska Bering Sea Beaufort Sea	All OCS areas concurrently July 1975 thru September 1976

IV. COST SUMMARY

	FY 76
Salaries and Benefits	14,600
Travel	0
Equipment	500
Misc. Supplies and Services	6,600
Total	21,700

V. PROPOSED RESEARCH

This proposal addresses Task A5 to determine primarily migratory routes and secondarily seasonal density distribution of marine birds. The study will include all species depending for a part or all of their life cycle on estuarine or marine habitats. It would be a companion study to the U.S. Fish and Wildlife Service proposal (Project 7) to study population dynamics of birds (Task A6). It would integrate all information on occurrence of birds at field camps and at sea collected by FWS and university and ADFG investigators. Without this integration, local information is not of its greatest utility as would be the case for weather data from a single reporting station unless it were analyzed with respect to other stations. It will be a continuing program.

Information on migration routes and seasonal patterns will be acquired by both direct and indirect methods. Banding of birds to be done in conjunction with studies of population dynamics will provide information on migration when birds are recovered or re-sighted. By requesting that all field and boat surveys provide local information at weekly intervals on occurrence of each of the more than 250 species of birds likely to be encountered a composite state-wide picture of migrations will emerge. This will be more comprehensive than the aerial and shipboard surveys since the composite time-frame is greater.

All OCS-related banding will be done under a single permit, with the exception of that being done by ADF&G in the Beaufort Sea which will be at their option, and banding of waterfowl under the most appropriate station permits. Analysis of recoveries will be done in conjunction with the proposal to study population dynamics at no additional expense.
Data from USFWS's proposal (Project 1) to "summarize and evaluate existing literature..." (Task A4) and other ongoing studies will supplement this proposal at no additional expense.

VI. INFORMATION PRODUCTS

Comprehensive report detailing period and abundance of migrants at coastal sites including annual variation.

Seasonal distribution of birds from specific colonies or nesting areas. (The largest portion of data in this category is based on banding and will accumulate for a period of several years beyond the present funding period).

Maps of Alaska and its offshore waters by month, showing distribution, relative abundance, and principal routes of migration. Verbal accounts above will describe adequacy of information.

VII. DATA AND SAMPLE EXCHANGE INTERFACES

Continuing review of data on populations, records of migrants, and occurrences of birds at all OCS study site locations will be required. Standard forms will be provided to all principal investigators for this purpose.

VIII. SAMPLE ARCHIVAL REQUIREMENTS

None required. Data will be archived as a part of other projects.

IX. SCHEDULE

Monitoring Stations Monitored:	April - May 1976
Cummulative Data Review:	July 1975 thru September 1976

X. EQUIPMENT REQUIREMENTS

Specialized equipment not required.

XI. LOGISTIC REQUIREMENTS

None.

WORK STATEMENT (Research Unit #341)

I. TITLE

Feeding Ecology and Trophic Relationships of Alaskan Marine Birds

II. CO-PRINCIPAL INVESTIGATORS

Calvin J. Lensink
and
James Bartonek

III. GEOGRAPHIC AREA AND INCLUSIVE DATES

Gulf of Alaska Bering Sea Beaufort Sea	Data and specimen materials will be collected throughout the funding period in conjunction with other OCS study proposals as well as from ongoing study programs of the Fish and Wildlife Service.

IV. COST SUMMARY

	FY 1975	FY 1976
Salaries	$ 2,000	$122,800
Benefits	1,000	42,500
Travel	250	6,110
Per Diem	250	16,950
Equipment	5,000	27,400
Other Direct Costs	500	19,100
TOTAL	$ 9,000	$234,860

V. PROPOSED RESEARCH

This proposal addresses Task A6, in describing trophic relationships of selected species at offshore and coastal study sites. Review of relevant published data will be completed as a part of another proposal.

Information on the feeding ecology of Alaskan marine birds is minimal for most species and nonexistent for others. The offshore, nearshore, and intertidal areas of the Alaskan coasts adjacent to the OCS lands are used by more than 82 species of birds which include at least 4 species of loons, 7 species of tube-nose swimmers, 4 species of cormorants, 15 species of ducks and geese, 2 species of raptors, 19 species of shorebirds, 16 species of gulls and terns, and 15 species of alcids. Other species use

these areas but not to the extent or the dependency of those enumerated. This proposal would include studies of dominant species within each group of birds.

Understanding the food requirements and other trophic relationships over a species' range is an acceptable and efficient way of determining its relative dependency upon a particular prey or food base. This proposal would therefore, collect and analyze information on feeding ecology and trophic relationships for key species in each of the three geographic areas, i.e. Gulf of Alaska, Bering Sea, and Beaufort Sea. Further, this proposal would integrate and analyze the regional or site specific information to determine spatial and seasonal variations occurring among the three geographic areas.

The collection of specimens will be done concurrently with other field studies, including but not restricted to those shipboard studies that are assessing seasonal density and distribution (Project 2; Tasks A4 and 5) and studying population dynamics (Project 8: Task A6).

Objectives:

1. Determine the types and quantities of food consumed by selected species and groups of birds including geographic, age-related, sex-related and seasonal differences in offshore, nearshore and intertidal areas in all three geographical areas.

2. Determine food selection or preference by comparing consumption to relative abundance and availability of prey organisms in areas of bird feeding and in adjacent areas with little bird use.

3. Identify feeding areas used by species and populations within species in both the breeding and non-breeding season.

4. Analyze existing information and concurrently collected data on the various oceanographic and biological effects that concentrate prey organisms in certain areas and how the periodicity of these effects affect bird feeding.

5. Determine the quality of food consumed by seabirds by analyzing prey organisms for caloric, fat, carbohydrate and protein and other nutrient content.

6. Provide input to other OCS proposals for developing a model to show trophic relationships between birds and their marine habitat in order that consequences of environmental changes can be predicted.

7. Determine the feeding behavior of Alaskan seabirds.

8. Obtain information on year-around population size and distribution, breeding colony size and location, and production as by-products of the other objectives.

9. Collect specimens for hydrocarbon and heavy metal analysis by other projects.

Procedures:

The emphasis of the field work will be on the more abundant species and groups of Alaskan birds using the offshore, nearshore and intertidal areas in the Gulf of Alaska, Bering Sea, and Beaufort Sea. Less common species will be studied incidentally as time allows.

1. The types and quantities of food consumed by birds will be determined by collecting individuals for analysis, observing what prey is being captured and observing what food is fed to young. Studies will emphasize seasonal, geographic, age-related and sex-related differences in diet. Analysis of foods in the digestive tract will be done on a volumetric, weight and percent of total food basis. Whenever possible these studies will be done in areas where concurrent studies on plankton, benthos and fishes are being conducted.

2. The feeding areas of some species of breeding birds will be determined by making boat and aerial transects from the breeding colony out to sea. The densities and activities of birds on these transects will be recorded. When possible these observations will be made simultaneously with sampling of prey organisms and nutrients in the water. Transects should be run periodically to determine daily and seasonal variations in foraging areas. Some birds will be color-marked or telemetered at the colonies to allow verification of the origin of the birds seen feeding at sea. The direction and intensity of flights to and from both colonies and feeding areas will be recorded.

3. Areas at sea or on the intertidal zone that are found to be used disproportionately higher than in adjacent areas will be sampled for prey desnities and availability and be compared with prey densities in adjacent areas where little feeding is occurring.

4. Areas where tide rips cause upwellings and feeding birds concentrate will be sampled for prey organisms throughout the day to determine the changes in densities and depths of major prey organisms. During the breeding season colonies near tide rips will be studied to determine how feeding rates and periods of breeding birds are affected by tide rips.

5. Quantitative and qualitative observations of feeding habits will be made for each species. When possible the success rates of the feeding activities will be determined. The time of individual dives and period of intervening surface activity for diving species will be determined. The depth of feeding will be determined by the placing of fishing nets at various depths. Such studies would be done throughout the year.

6. The effects of guano from colony nesting birds on marine productivity will be studied. Nutrient levels and biological

productivity in the areas of seabird colonies and at other areas of intensive bird use will be measured and compared with adjacent areas with little bird use.

7. The effect of the daily vertical migration in water or substrate of certain prey organisms on the feeding habits of birds will be studied.

8. The quality of the prey organisms consumed by seabirds will be determined by nutrient analysis.

Shorebased studies will be done concurrently with projects 2 and 7 describing population dynamics and identifying critical species and will involve man-power and cost-sharing with these tasks. Site-specific studies are needed at the following location and for the duration indicated.

	Intermittent Use (time in months)				
	June -Aug	Sept -Nov	Dec -Feb	Mar -May	June -Aug
Gulf of Alaska					
Seabirds (cliff nesting & colonial species)					
Middleton Island	(Other USFWS Study)	1	1	1	(Other USFWS Study)
Koniuji Islands	3	1	1	1	3
Barren Islands	3	1		1	3
Waterfowl, shorebirds, etc.					
Copper River Delta	3	1	1	1	3
Kodiak Island	3	1	1	1	3
Yakutat Bay	1	1	1	1	1
Bering Sea					
Seabirds (cliff nesting & colonial species)					
St. George-St. Paul	(Proposal by Hunt & Hickey)		1	1	(Proposal by Hunt & Hickey)
Cape Pierce	3	1		1	3
Cape Seniavin	1/2	1/4		1/4	1/2
Nome	(Proposal by Drury)				(Proposal by Drury)
St. Lawrence	3	1		1	3
Little Diomede	3	1		1	3
Unimak Pass (boat)	2	2	2	2	2
Waterfowl, shorebirds, etc.					
Port Moller, Nelson Lagoon	3	1		1	3.
Yukon Delta	3	1		1	3
Nome	(Proposal by Drury	1		1	(Proposal by Drury

VI. INFORMATION PRODUCTS

Expected products will be quantitative and qualitative accounts by species and groups of the food requirements and feeding behavior of birds in each area of OCS interest. Discussions will include an analysis of food habits and behavior in relation to distribution of birds and food organisms and intrinsic factors which may affect either, i.e. ocean currents, nutrient availability, etc.

VII. DATA OR SAMPLE EXCHANGE INTERFACES

Data exchange and coordination will be required from projects applying specifically to marine birds. Additional qualitative and quantitative data (progress or completion reports may be acceptable) from projects considering the abundance and distribution of plankton, pelagic fishes, and benthic organisms of the shallow water and intertidal zone.

VIII. SAMPLE ARCHIVAL REQUIREMENTS

All direct observations or analysis of food or foraging behavior adaptable to ADP will require storage on magnetic tape. Estimate 1000 records of undetermined format.

IX. SCHEDULE

Colony studies will be conducted seasonally May through September with progress reports for each local to be completed by December 31.

Shipboard collections will be adjusted to ship of opportunity without fixed schedule but to include all months. Progress reports for each voyage to be completed.

Final report integrating results from all site specific studies to be completed by December 31, 1976.

X. EQUIPMENT REQUIREMENTS

Specialized equipment that will require scheduled deployment will not be required. See list of other items in Cost Schedule.

XI. LOGISTIC REQUIREMENTS

Requires space aboard any vessel working in the Gulf of Alaska, Bering Sea, and Beaufort Sea that is doing either plankton, benthos, fish, mammal or other bird studies. A minimum of 2 weeks, preferrably 1 month, during each of the four seasons of the year in each geographic area of OCS interest is desired. This could be done

concurrently with Task 2, page 21 assessment of birds at little additional cost.

	June-Aug	Sept-Nov	Dec-Feb	Mar-May	June-Aug
Gulf of Alaska	1 mo	1 mo	1 mo	1 mo	1 mo
Bering Sea	1 mo	1 mo	1 mo	1 mo	1 mo
Beaufort Sea	1 mo	2 wks		2 wks	2 wks

Space aboard the U.S. Fish and Wildlife Service vessel operating in the Unimak Pass area is also required. This will be a man-power and cost-sharing effort with other FWS proposals to address Task 2, page 21. This would be a year-round need on an intermittent basis. Prorata share of operating boat is 0.2 yr.

A light aircraft would be used to identify nearshore and littoral areas where birds were foraging and where on-ground studies could be done. The hours of flying are:

	July -Aug	Sept -Nov	Dec -Feb	Mar -May	June -Aug	Cost* FY 76
Gulf of Alaska	10	10	10	10	10	5,000
Bering Sea	20	10	10	10	20	7,000
Beaufort Sea (see ADFG, Pitelka proposal)	0	0		0	0	12,000 (modified)

*Cost for light airplane estimated @ $100/hr and assuming ferrying costs are shared with other projects.

The following field camps will need to be established, resupplied and evacuated during each field season by boat, seaplane or both.

Gulf of Alaska
- Middleton Island (airplane out of Cordova)
- Barren Islands (seaplane or helicopter out of Anchorage or Homer)
- Little & Big Koniuji Islands (boat out of Kodiak, Sandpoint, Chignik)

Bering Sea
- Cape Pierce (seaplane out of King Salmon or Dillingham or boat from Togiak)
- Nelson Lagoon (boat from Port Moller)
- Little Diomede (boat from Wales or Nome)

Each of the sites will need to be established in May or June, evacuated in September and resupplied at least once during the summer during both 1975 and 1976 field seasons.

WORK STATEMENT (Research Unit #342)

I. TITLE

Population Dynamics of Marine Birds

II. CO-PRINCIPAL INVESTIGATORS

Calvin J. Lensink
and
James Bartonek

III. GEOGRAPHICAL AREA AND INCLUSIVE DATES

Gulf of Alaska
Bering Sea
Beaufort Sea

All OCS areas, May 1975 through September 1976*

*Project planning assumes continuation of studies for approximately 5 years beyond current funding period.

IV. COST SUMMARY

	FY 75	FY 76
Salaries	2,000	96,600
Benefits	500	31,800
Travel & Per Diem	500	31,780
Equipment	5,000	25,980
Supplies	500	8,900
Other Direct Costs	100	1,700
Sub-total	8,600	196,760
Logistics	500	108,000
TOTAL	$ 9,100	$ 304,760

V. PROPOSED RESEARCH

In fulfilling Task A6, this proposal would initiate a 5-year or longer study to determine population dynamics of a few of the more representative and abundant species of Alaskan marine birds. Since some species of birds are known not to be capable of production until 3 or more years of age, meaningful information on survival and contribution to production of various year-classes of some species may not be obtained until from 5 to 10 years after initiation of this proposal. However, this long term requirement does not preclude the collection and evaluation of shorter term information on gross dynamics of populations over larger geographical regions.

Populations of birds at specific sites in all three geographical areas will be appraised for productivity, production, and mortality. Information acquired at the various sites in all three OCS areas will be compared to evaluate the significance of differences. Studies being conducted by other OCS investigators (i.e., ADF&G and Pitelka in the Beaufort Sea; Hunt, Drury and Hickey in the Bering Sea; and Patten in the Gulf of Alaska) will be coordinated so that comparative data will be collected and can be analyzed under this comprehensive proposal.

Beached (dead) bird surveys will be conducted periodically at selected locations with sampling to utilize surrogate drift objects to assist in evaluation of results.

Causes and rates of mortality can be evaluated through recovery of banded birds. Banded birds also provide information on migration (Task A5) and affinities for natal and wintering areas. Banding will be a part of this program.

Long term expected results will include reports on: (1) yearly and regional variations in productivity, production, phenology of breeding, and mortality rates. Short term results will be based on only part of one breeding season and a full season which would indicate regional variations on phenological events and production.

Shore-based studies will be done concurrently with Project 6 (Task 6) describing trophic relationship and Project 2 (Task 5) identifying critical species and habitats and will involve manpower and cost-sharing with these tasks. Site specific studies are needed at the following locations and for the duration indicated.

	Intermittent Use (time in months)				
	June -Aug	Sept -Nov	Dec -Feb	Mar -May	June -Aug
Gulf of Alaska					
Seabirds (cliff nesting and colonial species)					
Middleton Island	(Other USFWS Study)	1		1	(Other USFWS Study)
Koniuji Islands	3	1		1	3
Barren Islands	3	1		1	3
Waterfowl, shorebirds, etc.					
Copper River Delta	3	1		1	3
Kodiak Island	3	1	1	1	3
Yakutat Bay	2	1			

	Intermittent Use (time in months)				
	June -Aug	Sept -Nov	Dec -Feb	Mar -May	June -Aug
Bering Sea					
Seabirds (cliff nesting and colonial species)					
St. George-St. Paul	(Proposals by Hunt & Hickey)			1	(Proposals by Hunt & Hickey)
Cape Pierce	3	1		1	3
Cape Seniavin	1/2	1/4		1/4	1/2
Nome	(Proposal by Drury)				(Proposal by Drury)
St. Lawrence	3	1		1	3
Little Diomede	3	1		1	3
Unimak Pass (boat)	2	2		2	2
Waterfowl, shorebirds, etc.					
Port Moller, Nelson Lagoon	3	1		1	3
Yukon Delta	3	1		1	3
Nome	(Proposal by Drury)	1		1	(Proposal by Drury)
Beaufort Sea					

No site specific studies are proposed for the Beaufort Sea, the studies proposed by the Alaska Department of Fish and Game and Connors (Pitelka) being adequate for that region.

VI. INFORMATION PRODUCTS

Both short and long term products will be archive records of populations and production on sample units within colonies, differing only in time scale.

Short-term Products: Analysis of production and mortality factors affecting key species at several geographic locations or breeding colonies.

Long-term Products: Analysis of seasonal variation in production and mortality, age structure of the population and variations in phenology of the breeding season and use of critical habitats.

VII. DATA OR SAMPLE EXCHANGE INTERFACES

This study is a companion study to all other Fish and Wildlife Service Proposals and will require integration and coordination of work and of results from these studies. Additionally, results from proposals by the Alaska Department of Fish and Game and Connors (Pitelka) in the Beaufort Sea, Drury, Hickey, and Hunt in the Bering Sea, and Patten in the Gulf of Alaska will be used for comparative data.

Sample interchange is not required.

VIII. SAMPLE ARCHIVAL REQUIREMENTS

Statistical data will require storage on magnetic tape. Record volume is estimated to exceed 2000 of undetermined format.

IX. SCHEDULE

Selected colonies will be occupied during the breeding season as described in tabular form in Section V.

Intermittent reports will be prepared as discrete units of work or data are completed but without predetermined schedule.

Progress and final reports will be submitted as required.

X. EQUIPMENT REQUIREMENTS

Specialized equipment is not required. Support and logistic equipment required is listed in Cost Schedule, Section XII. Use of this equipment will be coordinated with other FWS projects.

XI. LOGISTIC REQUIREMENTS

The following field camps will need to be established, resupplied, and evacuated by boat, seaplane, or both, since they are not accessible by land or serviced by scheduled air service:

Gulf of Alaska

Middleton Island (airplane out of Cordova)
Barren Islands (airplane out of Anchorage or Homer)
Little & Big Koniuji Islands (boat out of Kodiak, Sand Point, or Chignik)

Bering Sea

Cape Pierce (airplane out of King Salmon or boat from Togiak)
Nelson Lagoon (boat or plane from Port Moller)
Little Diomede (boat from Wales or Nome)

Each of the above sites will require boat or air service for establishment in May or June 1975 and evacuation in September 1975 and the same for 1976. Resupply should be on a regular basis at least twice each field season.

A vessel operating year-round in the Unimak Pass area will be required. It will be cost and manpower-shared with other proposals, especially that related to trophic relationships and seasonal distribution (Task 3, page 22, and Task 2, page 21). It should be capable of resupplying land-based studies in Bristol Bay (FY 75 & 76) and in the Gulf of Alaska in FY 76. Surplus government T-boats (65-ft.), if available, can be refitted for $130,000 and can be operated for $20,000 per year plus crew. In lieu of this boat, fishing boats could be chartered for 200 days a year @ $500 per day for $100,000/yr.

WORK STATEMENT (Research Unit #343)

I. TITLE

Preliminary Catalog of Seabird Colonies

II. CO-PRINCIPAL INVESTIGATORS

Calvin J. Lensink
and
James Bartonek

III. GEOGRAPHIC AREA AND INCLUSIVE DATES

Gulf of Alaska Bering Sea Chukchi Sea Beaufort Sea	Concurrently all OCS Areas July 1975 thru September 1976

IV. COST SUMMARY

	FY 76
Salaries and Benefits	19,000
Travel	500
Equipment	800
Supplies and Services	5,000
Total	25,300

V. PROPOSED RESEARCH

This proposal addresses Task A5 to determine critical habitats and breeding locales for principal marine bird species.

The objective of the study is to identify and describe all colonies of seabirds on the coast of Alaska adjacent to proposed OCS development areas.

Since 1969, the U.S. Fish and Wildlife Service has been accumulating information on the location, extent, species composition and species abundance of seabird colonies throughout coastal Alaska for the purpose of preparing a catalog. Man-power limitations have permitted only a token effort towards completing this preliminary catalog. The word "preliminary" is stressed since the quality of data on the colonies is often poor and the regional coverage is incomplete. Investigations of seabirds during the next 2 years will greatly increase the information on these colonies.

This proposal would gather that information which is already in possession of USFWS, that which will be gained through a proposed review of literature, and that obtained from other proposed OCS-related studies and on-going USFWS studies.

This information will be used to prepare the preliminary catalog which will consist of 1:250,000-scale maps showing the location and the extent of the colony. The colony identified on the map will be referenced in tabular form to recent or historical information or both on size and species composition, source and quality of information.

Additionally, summary maps of 1:1,000,000-scale will be prepared for each species of colonial nesting seabirds. Accompanying the summary map for each species will be a table listing references to colonies identified on the 1:250,000-scale maps where that particular species has been found.

Tabular summaries will include an evaluation of data accuracy. This index is considered essential for future data refinement or evaluating future changes in status of the colony.

VI. INFORMATION PRODUCTS

Catalog of seabird colonies arranged by geographic region with locations identified by latitude and longitude and indexed to appropriate USGS 1:250,000 maps and to USCGS Nautical Charts. Catalog to be of loose-leaf format to permit updating of information on colony size, status and composition as new information is acquired. See sample format attached.

Mapped record showing exact locations and limits of colonies.

Archive record (Environmental Data Service/NODC) of colonies providing geographic location, estimates of total population by species and other data as indicated on attached form for Colony Status Record.

VII. DATA OR SAMPLE EXCHANGE INTERFACES

Information from all ongoing OCS studies related to colony structure or status will be required.

VIII. SAMPLE ARCHIVAL REQUIREMENTS

Storage of data for all colonies on magnetic tape. Estimated volume is 500 colony locations with additional update records in format of colony station record (see attachment).

IX. SCHEDULE

Study will be in continuous progress July 1975 through September 1976.

X. EQUIPMENT REQUIREMENTS

No specialized equipment required.

XI. LOGISTIC REQUIREMENTS

None required.

COLONY STATUS RECORD

Region _____ Colony No. _____

Geographic Coordinates: Latitude _____ Longitude _____

Geographic Name: _____

Maps: USGS _____ USCGS _____

Species Composition:

Species	Identification No.	Nests	Individuals
Northern Fulmar	040301		
Fork-tailed Petrel	050101		
Leaches Petrel	050104		
D'ble-crested Cormorant	060101		
Pelagic Cormorant	060103		
Red-faced Cormorant	060104		
Gl'winged Gull	280105		
Black-legged Kittiwake	280301		
Red-legged Kittiwake	280302		
Black Guillemot	300301		
Pigeon Guillemot	300302		
Common Murre	300101		
Thick-billed Murre	300102		
Ancient Murrelet	300501		
Rinocerous Auklet	300901		
Parakeet Auklet	300701		
Crested Auklet	300801		
Least Auklet	300802		
Cassin's Auklet	300601		
Horned Puffin	301101		
Tufted Puffin	301201		
	Total all Species		

Description of Colony:

Sample plots or points established:

Photo coverage available:

References:

Data Status:

Date Cataloged: